U.S.I. JOURNAL

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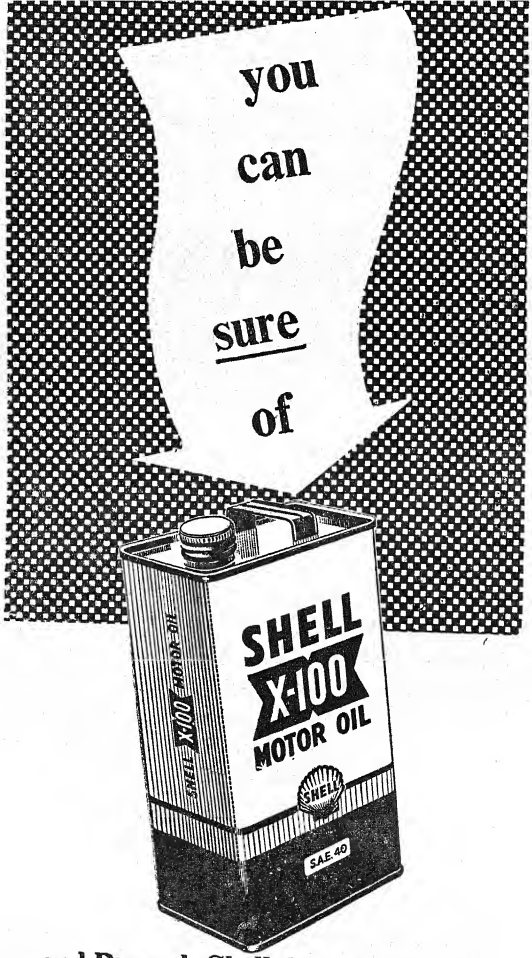

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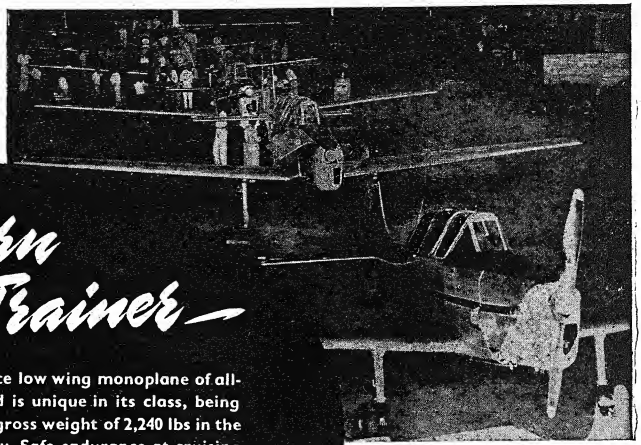

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EDITORIAL NOTES

Designations of Service Heads

The change in the designations of our Service heads—abolishing the title of "Commanders-in-Chief"—which came into effect on 1st April, has not come as a surprise. It was in the early years of our independence that the proposal was first mooted, but the matter was shelved for the time being for a variety of reasons. Now that conditions have settled down, the new Army Act published, and Indianisation almost completed in all three services, there is no longer any reason to postpone this democratic step.

There are no mature democracies where the title or function of Commander-in-Chief in the home country vests in a Serviceman, for the true control of the armed forces must be kept in the hands of the civil government or the Head of State direct. In the British system, which we have always followed in matters of organisation, Commanders-in-Chief are appointed only for a particular theatre of operations, a particular campaign, or for some individual self-contained task, in peace or war. Even in India, it is only since 1947 that the Commanders-in-Chief have in effect been non-political appointments. Before independence, it was the 'War Minister' (*i.e.* Honourable Member for Defence in the

Executive Council) who wielded power as Commander-in-Chief. This was in accordance with British practice, even if his status as a serving soldier is to be argued, for he was a British Commander-in-Chief in an oversea theatre. After independence, therefore, the title of C-in-C of a service in India became inconsistent both with the military system which we have always followed and normal democratic practice.

Merely dropping the title of C-in-C however will not solve the present problem of service reorganisation, for there are other shortcomings in our present Defence set-up which need revision, as indeed was hinted by the Prime Minister in his announcement in the Lok Sabha. Under the existing system, there are too many procedural difficulties in the way of policy decisions at higher levels. The recommendations of the Chief of Staff are reckoned to be too far removed from the final authority, and it has been suggested that we should adopt the same system as in Britain—*i.e.*, the Army Council, the Admiralty Board and the Air Council.

It might therefore be interesting to examine briefly the "Board" or "Council" system adopted by Great Britain after the Boer War. Under this system all major military decisions are taken on a broad basis, after consideration directly by the Minister in consultation with the Services and not through the medium of a non-professional civil secretariat (as in India). Thus, the Army Council is presided over by the Secretary of State (or Minister) for War, and includes the Parliamentary Under Secretary for War (who is an elected member of Parliament, and is also the Financial Secretary to the War Office), who acts as Vice-President. The Military members are the CIGS, the VCIGS, the AG, the QMG and the DCIGS. Although there is no "Chief of Staff" as such in the British Army, for purposes of the Army Council the CIGS acts as a "Chief." The permanent civil servant on the Council, the "ICS" counterpart, is the Permanent Under Secretary of State for War, (or Defence Secretary), and is the Secretary of the Council.

That this system has great advantages compared to our own is acknowledged by those who are concerned with the reorganisation of our military set-up. When a decision is taken, it is taken at the highest level, and is taken after the

opinions of all the "experts" have been heard in common discussion. There can be no wasteful delays whilst some financial expert considers the problem in the seclusion of his office, or whilst some extra professional paper argument develops on the files in the civil secretariat. At the same time, responsibility for decisions on matters of urgent and national importance does not rest with any one individual, but is shared by Parliament, the Services and the civil secretariat. Whether this system will be adopted in India, or even a modification of it, has not yet been finally decided. To quote from the Prime Minister's speech on Defence Estimates, "No doubt, it may be desirable for us also to form these Councils. We shall look into this matter. We cannot, of course, produce a Council suddenly. A Council represents a great deal of experience and accumulated knowledge of our senior officers. But we are going into this matter and hope gradually to develop these councils for each of these services."

The Royal Navy in a Future War

There has been much recent controversy over the post-war policy regarding the British Navy. During a debate in the House of Lords in December last, and also at the diamond jubilee meeting of the Navy League in January 1955, there was considerable criticism of the Government's policy in allowing the strength of the Navy to run down after the Second World War. The Admiralty has considered much of this criticism to be ill-judged and exaggerated. It will be of interest therefore to examine this question from the lists published in the annual Naval estimates. The questions which naturally spring to the mind are, "What are the facts about the Post-war Navy? What would be its effectiveness in the event of another war?"

The present strength of the Royal Navy, in a nut-shell, is as follows:—

One fast battleship in commission and four in reserve; nine carriers in commission and eight in reserve; (of those in commission three are of the latest light fleet carriers of the 'Hermes' class; the cruiser position shows eleven in the Active Fleet and thirteen in reserve; twenty-one destroyers in commission and sixty-four in reserve and the

numbers for submarines are forty and eighteen. As regards ocean and inshore mine-sweepers, there are fifty-three in commission and two hundred and sixteen in reserve. These mere figures can of course give no real indication of the effectiveness of the Navy, nor can they convey its true strength. It is significant however that the Royal Navy still remains the second largest marine force in the world, a fact not often borne in mind by its critics.

It is also to be remembered that the Royal Navy by tradition has always considered itself to be no more than a holding force during peace, and depends upon its rapid expansion in time of war for its true potential. The Reserve is always kept ready for mobilisation, and thus enables the Active Fleet to expand by 75 per cent at very short notice. The active peace-time strength is at present 133,000 officers and men, as compared to the strength of 861,000 at the end of the last war. Immediate reserves in manpower today total 250,000 including 85,000 highly trained officers and men.

The Admiralty holds that these figures and the state of readiness of the Navy as maintained by tradition give an effective answer to much of the ill-informed criticism that has recently been levelled at the Royal Navy. The figures are evidence that the lessons learnt from the Second World War and the period following the War have been applied to the Fleets of today and the future. The age of the heavy capital ships is over. Today's biggest new ships are the aircraft carriers, which have the requisite mobility for dispersion for nuclear warfare. Surface attack is concentrated in cruisers and destroyers. Since the atomic age also emphasises the potentialities of under-water craft, a modern Navy must be strong in submarines as well as the smaller craft which counter them. It is the fast small ships which may well decide the issue in atomic war.

Two copies are required of all articles sent to the Editor. These should be typewritten with double-spacing, and on one side of the paper.

THE PRINCIPLES OF WAR

MAJOR-GENERAL W.D.A. LENTAIGNE C.B., C.B.E., D.S.O.

Lecture on Tuesday, 29th March 1955

[With Major-General Tara Singh Bal in the Chair]

THE CHAIRMAN: It is my privilege today to introduce to you Major-General Lentaigne, the Commandant of the Defence Services Staff College, who will address us on the 'Principles of War'. General Lentaigne, as some of you may know, will be leaving us some time in May and this is perhaps his last talk to us. You also know that his previous talks on military subjects have been of great inspiration and instruction to us. I am sure his present talk will be of equal benefit.

LECTURE

IN these materialistic days everyone searches for yardsticks, formulae, precise orders, instructions and so on to regiment and direct their lives and work. Having created an armoured shell of these inside which to exist with no responsibility and no need to make decisions, the average officer reckons he has achieved the nadir of efficiency and can sit back till he reaches the highest rank with no further effort. This process of emulating the sluggish tortoise is further stimulated by Audit with its strangle-hold on the daily routine work of the officer in peace which is rapidly stifling initiative, decision and the willingness to accept responsibility. As a result paralysis has spread to his strategical and tactical outlook. In short, our minds are becoming standardized one-job machines oiled by rigid orders and adjusted and maintained by yardsticks and other inflexible tools. Art has given away to pseudo science so that our output is more akin to mass produced Birmingham brass-ware exported to India for sale on the verandahs of Oberoi Hotels, than to the exquisite brass figurines of the craftsmen of ancient India.

Consequent on this, every officer has at his tongue tip an inexhaustible store of "Principles" from which he glibly pours out an appropriate list to meet whatever situation he is facing, much as a golfer pulls out the appropriate club to play each stroke in his progress from tee to green. I would

suggest that the term " principle " be restricted to the only real principles of the military art—the Principles of War—and that slogans, shibboleths, yardsticks, formulae and so on in all tactical and strategic discussion and writing be treated with extreme mistrust and never given the undue importance they are never worth by being termed principles.

True Principles

After all what is a principle ? The dictionary defines it as a fundamental truth, law or doctrine from which others spring. Now I often hear officers talking of the " principle " of never using armour in penny packets or the " principle " of offence being the best defence. These two slogans are in fact doctrines that spring from the two Principles of War of Concentration and Offensive Action. They are not therefore *fundamental* truths, laws or doctrines and cannot by any stretch of the very elastic English language be true principles.

Now the dictionary says that a principle is a fundamental truth and so on. It does *not* say that it will be rigidly observed. In fact Man in his perversity, if he is at all progressive, is always seeking to overcome fundamental truths, laws or doctrines and is acclaimed a genius or a criminal, depending on the circumstances, if he succeeds. For example, the Principle of Gravity or " What goes up must come down " is being challenged daily by those who dream of space ships, earth satellites and the like. The balanced officer, even if he is not a genius, and I hope he cannot be classed as a criminal, is he who weighs up the principles of war and gives to each the correct emphasis required for each situation.

The Principles of War must therefore be applied rather like certain principles we all use in our day to day life. Games players have the principle of " Keep your eye on the ball " and " get your footwork right." Now quite often a cricketer will shut his eyes and take a blind swipe at a full pitch. If his footwork is right he may very occasionally score a six, but if both eyes are shut and his footwork is bad he will probably be out. We must therefore use the principles of war as guides, always consider them all and apply each to the requisite degree to achieve our aim.

How Were They Evolved ?

So far so good, but how have these Principles been evolved ? You have ten of them in the official manuals today. Who invented them ? Ever since Man learnt to write, he has written of Love and War. These are the two most important things in his life. The earliest known writer on the

Principles of War (he also wrote on the Principles of Love), was a Chinese named Sun Tzu who wrote in 500 BC., nearly twenty-five centuries ago. He said more than a lot about these Principles, but he said it in a lot of words, and his approach was different.

I will give you examples of his Principles. On Concentration he said, " if our troops are no more in number than the enemy, that is amply simple. It means that no attack can be made without extreme hazard. What we can do is to collect all our available strength, keep a close watch on the enemy and obtain reinforcements." Again, in respect of Morale he wrote, " The sight of men whispering together in small knots and speaking in subdued tones points to dissatisfaction among the rank and file. Such an army will not win the battle. Let the Commander send for the families and order a feast." Which proves that ENSA was not a new idea of World War II.

After Sun Tzu there have been innumerable writers on the Principles of War—Julius Caesar ; Napoleon and his biographer Jomini, who had 115 maxims or principles—rather a long list ; Clausewitz the German ; Henderson an early DS at Camberley ; Admiral Mahan an American who, however, wrote mostly about British Naval Strategy ; Foch, Commandant of the French Staff College and Generalissimo of the allied armies in France in World War I ; General Fuller who enunciated eight Principles in 1920 and got them adopted by all three Services. And finally Montgomery who gave us two more Principles in 1946 which were accepted by all three Services in 1947.

Montgomery's Ten Principles Compared To Other Authorities

Now let us check up on just a few of these experts, as also the Americans, examine their lists and see why they vary. Incidentally the American Navy do not enunciate any Principles of War but recently Admiral Connolly has written an article on them and given a list. On this Chart (page 96) I have shown the Principles of War as enunciated by a few authorities.

We will take Montgomery's ten Principles accepted by the three Services in 1947 as a yardstick. There they are (on the Chart) in no particular order.

Administration

It is at once apparent that Administration is not given by any of the others except perhaps Admiral Connolly, while surprisingly the American

PRINCIPLES OF WAR

British Inter Service 1920 General Fuller	British Army Fd. Service Regs Vol. III 1935	Marechal Foch 1914	General Nye	British Inter Service 1947 (F.M. Montgomery)	United States Army	Admiral Connolly US Navy 1953
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)
Maintenance of Objective	Maintenance of Objective	..	..	Maintenance of Aim	The Objective	The Objective
Offensive Action	Offensive Action	Offensive Action	..	Offensive Action	Offensive Action	The Offensive
Security	Security	..	..	Security	Security	Security
Concentration	Concentration	..	Concentration	Concentration	Mass	Concentration
Economy of Force	Economy of Force	..	..	Economy of Effort	Economy of Forces	Economy of Force
Surprise	Surprise	..	..	Surprise	Surprise	Surprise
Mobility	Mobility	..	..	Flexibility	Manoeuvres	Mobility
					Simplicity	Simplicity
Co-operation	..	..	..	Co-operation	Unity of Command	Control (Co-operation + Unity of Command).
British Army Field Service Regs Vol. I (Organisation and Administration) 1935 gives the essentials of Administration as—	Elasticity	..	..	..	..	Readiness (of Material and Personnel)
	Unity of Effort Decentralization of Control			Administration	..	..
	Economy			Maintenance of Morale		Exploitation (Offensive + Surprise)

Army who pride themselves on Administrative efficiency do not mention it. But don't imagine that Montgomery has really thought up something original. Remember Napoleon said " An Army marches on its belly " and Sun Tzu also talked about food and war. Well, why do the American army exclude Administration ?

As I see it, America had ample warning before she became involved in either of the two World Wars. She saw how both times the Allies nearly lost at the outset through administrative unpreparedness, and on both occasions, when she entered the war, she had got her Administration organised. She has never been really extended in war, in fact except for World Wars I and II has never fought in a major war with the possible exception of the recent UN Korean Campaign. She has never had to scrape the barrel dry. In fact, when she started fighting she did so with good administration and her Commanders in the Field more or less took it for granted. Remember that Service Manuals are written by Commanders and Senior Staff Officers. So also did British Commanders up to Corps and equivalent level take Administration for granted in the closing stages of the last war, but not Montgomery. He had commanded a Division at Dunkirk and realised that we were beaten then by insufficient resources. Later, he took over in the Desert and again realised that he could never beat Rommel till he had enough of everything. Finally, he was in on the planning of ' Overlord ' and realised that that operation was bound to fail unless Administration was on a 100% efficient basis. I feel that American commanders in the early stages of the Korean show must have been extremely conscious of the importance of the Principle of Administration and it may well be included as a Principle by the Americans in the future.

But let's consider why Fuller in 1920 and the Army FSR of 1935 did not show Administration. I think the reason lies in the fact that Fuller and the authors of FSR were both pre-1914 professional soldiers. Prior to 1914, there was the General Staff which was predominantly " G ". A few unfortunate (and generally speaking unpopular and even inefficient officers) were given " A " and " Q " jobs, but in the eyes of the Army " G " was the only branch worth serving in. " A " and " Q " were looked on as jobs for civilians, lawyers, contractors and the like. For example, QMG's Branch at Army HQ India did not have a single trained Staff Officer apart from the QMG himself up to about 1930. There were several Directorates —Supply, Transport, Veterinary, Remounts, Farms, Movements and Accommodation—but these consisted of officers of those Corps who were

not staff trained and were advisors rather than Staff Officers. Both Movements and Accommodation were run by sappers, who were drawn from somewhat peculiar types considered too odd and intellectual to serve in Field Companies or Squadrons let alone to be nominated for the Staff College. In the same way, Ordnance was run by Gunners considered to be too serious and technical to serve in Horse, Field or even Coast or Mountain Batteries. Even in World War I, "A" and "Q" were unpopular. In trench warfare little originality was required for Administration. "G" said they would attack at a certain spot and "Q" fixed D Day as and when they could move the attacking formations up to the start line and dump the required gun ammunition. Even after World War I, all the best students from the Staff College went to "G" until as late as about 1930 when the importance of Administration began to be recognised. All this applies with even greater force to the Navy. Administration was the job of the supply branch, the dockyard, the victualling and stores departments. No officer of the executive branch ever dreamed of dabbling in Administration. So too, in the Air Force. Pilot Officers hardly deigned to speak to the "ground jobs"—the Equipment and Armament Branches. Remember too in those days it was the Executive Officers who wrote the operational and training manuals. They took Administration for granted. In the Army, you did have FSR Volume I, entitled Organisation and Administration. It was written by Administrative Officers and it said that good Administration was achieved by Elasticity, Unity of Effort, Decentralization and Economy. This is only another way of saying Flexibility, Co-operation and Economy of Effort.

Morale

Now we will take Morale. Again, Montgomery is not on to something new. I have already told you what Sun Tzu said, while Napoleon, you will remember, said, "The Moral is to the Physical as three to one." Why was Morale not included by Fuller and these others? I think the answer is that they were professional officers thinking of small professional forces. Professional officers always consider that the Morale of their regular troops can be taken for granted. It is only when the command becomes diluted with conscripts or hurriedly trained war reinforcements that they realise how important Morale is. In short, professional officers are apt to look upon Morale as axiomatic. Napoleon and Montgomery had to command forces that were worn out by a long drawn out war; forces composed of civilians; forces that did not subscribe to the theory of iron discipline; forces that were not trained and ingrained with the motto

" Theirs not to reason why. Theirs but to do or die." Note that the American Army also does not include " morale " but Admiral Connolly hints at it in his Readiness, which he qualifies by the phrase " of personnel and material." Personnel to be ready must have excellent morale. The British Navy hold that Morale is the most important single principle.

Co-operation

Now let's look at Co-operation. Fuller had it in 1920, Montgomery has it, the Americans have it. But FSR 1935 dropped it. Why ? Well, by 1935 we had had seventeen years of peace. Hitler was still a funny little Austrian painter with a lot of drama and emotion in his following and all in all nothing more than a joke. The British Army was back to its normal job of imperial policing ; so was the British Navy. As to the Air Force they too were operating self-contained. Remember the evacuation of Europeans from Kabul at the time of the rebellion against Amanullah ? True, Army-Air co-operation was practised but this was confined to a few Army co-operation squadrons mostly on the North West Frontier of India where about 50% of the pilots were army officers seconded to the Air Force. In short, each service was working separately on small shows on the " old Boy " net—a Brigade group on the North West Frontier ; a river gunboat or two up the Yangtze ; the RAF running Aden and Iraq with their own private ground troops, officered by grounded pilots. There was little or no inter-service training and even less inter-service operations. The lessons learnt the hard way at Gallipoli and on the Belgian Coast in World War I had faded from memory. Co-operation was in fact rather taken for granted inside each service and the necessity for inter-service operations was forgotten.

Note that the American Army talk of Unity of Command rather than Co-operation. I think they are wrong here. A Supreme Commander cannot always ensure Co-operation. The President is the Commander-in-Chief of the armed forces of the United States, but that Unity of Command has not achieved Co-operation between the Navy Marines and Air Force today, while it failed to achieve it during the war as between the operations of MacArthur and Nimitz in the Pacific, and Stilwell and Chennault on the mainland of Asia. In sum, I prefer Co-operation to Unity of Command. Though I will admit the British have fallen down over this on occasion, for example Walcheren 1794 (I think), when " the Earl of Chatham with his sabre drawn stood waiting for Sir Richard Strachan. Sir Richard Strachan longing to be at'em stood waiting for the Earl of

Chatham." Co-operation was largely responsible for the winning of World War II chiefly because though Germany had Unity of Command under Hitler, she never had Co-operation between the three Services, whereas the Allies had it in a big way as between nations and also between the three Services. But perhaps after all Admiral Connolly has hit the nail on the head when he advocates Control to include both Co-operation and Unity of Command. Anyhow, don't let Co-operation die in peace.

Flexibility

I would like you now to note the difference between Fuller's Mobility and Montgomery's Flexibility. Fuller thinking over old wars and particularly the Boer War with its Boer Commandoes and World War I, with its line of trenches from the sea to Switzerland, thought only of speed of movement and the ability to cross undeveloped country or areas torn to pieces by rain and shell fire. If you could move quickly and anywhere you were better than the enemy, just as the Boers were in South Africa and he hoped in World War I that we would be if we developed the Tank. But Montgomery had to fight in the Desert with an always open flank and quick moving, hard hitting enemy armoured forces as well as the air to contend with. Later in France with Tactical Air Forces that could paralyse German movement, he realised that Mobility must also include the ability to take on quickly sudden and new problems and threats. It was no use being able only to move quickly. As an example, a modern jet fighter-bomber is the essence of Mobility, but if when the pilot spots a ground target he cannot *think* quickly and dive down to attack, he will overshoot it. As to our friends, the Americans, they have two Principles to our one of Flexibility. They say, Simplicity is essential to achieve Flexibility and they have another Principle which they call Manoeuvre or Mobility which is necessary to enable you to Concentrate at the proper time and place.

Maintenance of the Aim

Next we will take Maintenance of the Aim—a better phrasing than Maintenance of the Object, as Object is so often confused with the physical Objective. Montgomery calls this the master principle. He states that the Ultimate Aim is to break the enemy's will to fight. I wonder if he is right. Remember North Africa. The Italian will to fight was broken in that campaign, still they went on fighting for a long time—in fact until they thought they were reasonably safe from German reprisals. Hitler himself continued the fight till he knew that within a few hours or minutes he would be captured or killed, while his armies had long realized that vic-

tory was unobtainable but continued to fight until Hitler was dead. In short, I think the better definition is to make it *impossible* for the enemy to fight in that if he tries to do so he is killed. In the past this has only been achieved by physical occupation of his country. In the future it may be achieved by attack by weapons of mass destruction.

Surprise

What about Surprise ? Everybody has got that except Generals Nye and Foch. Surprise can be of four kinds—Political, Strategical, Tactical or Equipment. We were politically surprised when Russia and Germany signed a no war pact in 1939. We were strategically surprised when Germany occupied Norway. The Americans were strategically surprised at Pearl Harbour, but made up for it by achieving strategical Surprise in the North African landings. Tactical Surprise was attained on D Day in Normandy. Von Rundstedt knew we were coming any day but thought we would come further North near Calais. Equipment Surprise was achieved by Gas at Ypres in 1915, by the tanks at Cambrai in 1917, at Hiroshima, and by the Mulberry Harbour at Arromanches. Remember Deception is a means of achieving Surprise.

Security

Security appears to be another popular one. It is in other words the principle of the Firm Base. Navies without secure bases, Air Forces without secure airfields, Armies without secure communications are all pretty certain of defeat. If you are secure in these respects you can undertake Offensive Action.

Economy of Effort

Economy of Effort or Force is self-evident. If you go in for super Security everywhere you will never achieve concentration or Mass as the American Army calls it, and will not be able to undertake all-out Offensive Action to attain your Aim.

Concentration

That leads on to Concentration or Mass. General Nye, when lecturing out here a few years ago, said that it was the *only* Principle. He was lecturing on the Higher Direction of War as he saw it as Vice Chief of the Imperial General Staff in World War II. His task then was to give to the Commanders in the Field everything they needed to achieve victory. Concentration was his God. Concentration of Men as well as Material. Note that Concentration must be at the Right Time and at the Right Place. Another advocate of Concentration was Bomber Harris.

Offensive Action

We are left only with Offensive Action. You will note that I have shown this as Marechal Foch's only principle. I have read his book "Precepts and Judgements" three times and frankly that is the only principle that I ever found in it. Offensive Action is vital to achieve your Ultimate Aim. Foch had it. Remember his dictum in 1914, "My flanks are encircled, my front is penetrated, the situation is excellent, I attack." But he could only attack because his troops had superb Morale, because his artillery was at the time the best in the World, (the *soimante quinze* with its barrage fire which had been newly invented was an example of Weapon Surprise), and finally, because the enemy—the Germans—had over-extended and had not got concentration at the right time and the right place, *i.e.*, on the Aisne when Foch put in his counter-attack with Goureau's taxicab army from Paris. Compare Foch in 1914 with Gamelin and Petain in 1940. The Principle of Offensive Action was dead, and buried deep under the Maginot Line. Morale was sapped by Communism, Fifth Column and fear that France once again would be devastated. Surprise was non-existent—we sat there on the frontier and conformed to the enemy. Concentration was represented by a long thin line along the frontier with no reserves. Administration was indifferent and soon broke down under dive-bombing attacks and roads blocked by refugees.

Turning to the Naval aspect for a moment, Offensive Action has always been the key principle in British Naval history at a tactical level. The British Navy has never worried about losing ships in action and has always attacked even against colossal odds. Remember Sir Richard Grenville, in his ship "Revenge," who single-handed fought fifty-three Spanish ships. Again, Beatty with his battle cruisers, who attacked the whole German fleet at Jutland in 1917 instead of waiting for Jellicoe with the battleships to come up. Compare this with the Italians who with vastly superior forces in the Mediterranean in the last war, always avoided action. Again, the Germans in the 1914-18 war, who always avoided a fleet action with the result that in the end their ships were scuttled by themselves.

ADMIRAL CONNOLLY'S LIST

Lastly, let's run over salient points in Admiral Connolly's list, the very latest model in fact:—

The Objective .. Like Montgomery he calls it the Master Principle. I prefer "Maintenance of the Aim."

The Offensive	..	I prefer "Offensive Action."
Security	..	No comment
Concentration	..	Good—better than "Mass."
Economy of Force	..	Better "Forces"
Surprise	..	No comment
Mobility, Simplicity	...	Why not Flexibility ?
Control — Co-operation and Unity of Command		Good
Readiness — Material and Personnel		Suggest Administration and Morale
Exploitation — The Offensive and Surprise		This only repeats Offensive Action and Surprise.

CONCLUSION

To sum up, the Principles enunciated by Montgomery and Admiral Connolly contain nothing new. They have been known for centuries, but different emphasis has been put on them from time to time, and from time to time some of them have been almost forgotten. *You* too must put different emphasis on them each time you are called to use them. You are at liberty to give little or no weight to some of them before you embark on a particular plan. These principles are like the instruments in a dance band. For each tune and for each phase of each tune their individual emphasis is varied. At times all are going full blast; at others some are not playing at all while others play a few notes, not the full melody, or are muted. This variation in emphasis gives you the rhythm, the hottachha or whatever you call it, and marks the difference between a first class dance band and the brass band of the Kuch Parwani Rifles who play a samba, foxtrot or waltz all the same way—the way they play a march past. The difference in emphasis is Art. There will be no Art—and that means no victory—in your operations of war if you always give the same emphasis to all the Principles all the time.

DISCUSSION

MAJOR O.D.P. RATNAM: Do you think that improvisation could be added as another principle of war, especially in view of the fact that many things have to be improvised under battle conditions.

THE LECTURER: I think it is a good point. I think it comes under Flexibility.

MAJOR O.D.P. RATNAM: What I meant was, that in an Army like ours, under present conditions, we have to be improvising all the time—possibly as a part of Administration.

THE LECTURER: I agree that it can come under both Administration and Flexibility, but you must be able to improvise both operationally as well as administratively. All your thoughts, plans and acts must be flexible both operationally and administratively and if you are deficient of anything you must improvise. A good example recently was L/Nk Suchet Singh of the Sikh Regiment who killed a tiger with his bayonet when out on training. This was improvisation of a high standard since no one normally would consider that to be the correct use of the bayonet or the correct way to kill a tiger.

THE CHAIRMAN: You will all agree with me that General Lentaigne has given us a very interesting talk in a clear manner on certain fundamental principles for the Armed Forces—principles which one is taught in the early stages of one's career in the Service. These principles, as he has explained while summing up, are to be taken as a guide and their values will vary in any particular situation. The emphasis laid on one of these principles in a certain situation at a certain time may be very different from the emphasis laid on the same principle in another situation at another time. Thus the emphasis on each principle differs according to the varying situations prevailing from time to time. In other words we must not be bogged down too much by these principles, and will have to take calculated risks in order to cope with the varying operations of war.

I do wish to say that I feel rather happy hearing this lecture, because General Lentaigne first touched on Administration. Usually, one finds a lecturer talking about offensive action, concentration and so on, and poor 'Q' comes in last. The importance of Administration needs emphasis, how closely it is tied up with the success of an operation—hungry stomachs, dry engine tanks and empty magazines will never win wars.

Lastly I would, on your behalf and mine, like to thank General Lentaigne for his last lecture to U.S.I. (*Applause*).

THE LIGHT FIGHTER

ITS CONTRIBUTION TO AIR DEFENCE

W.E.W. PETTER, C.B.E., F.R. AE. S.

Lecture on Monday 4th April, 1955

[With Air Commodore Arjan Singh, D.F.C., I.A.F., in the Chair]

THE CHAIRMAN: I have pleasure in introducing Mr. Petter who is the Managing Director and Chief Designer of Follands Aircraft Ltd., England. He has come out to India in connection with the GNAT light-weight fighter, which he has recently designed and in which the Government of India is interested. Whilst with the English Electric Company as Chief Designer, he designed the famous Canberra aircraft, which is being used in many countries in various roles and is being produced in America under licence. I think many of you may remember that the Indian Air Force was, soon after the last War started, equipped with the Lysander aircraft. That was also designed by Mr. Petter and the I.A.F. used that aircraft when it went into operations against the Japanese in Burma. Mr. Petter has very kindly agreed to give us a talk on "The Light Fighter."

LECTURE

THE PHILOSOPHY

THE actual situation as we find it today is that the size and complexity of modern fighter aircraft have so increased in the last ten to fifteen years that very serious questions are arising in the minds of the users.

Cost has reached a point of over £100,000 sterling fully equipped, for the "normal" single-seater fighter, which means that only small numbers can be used by any but the most powerful states.

Some 40,000 tools are required for the air frame manufacture and this inevitably delays the starting point of production and so shortens the useful life of the aircraft before it becomes obsolescent.

The relatively small numbers increase the cost still further because mass production never becomes established, the benefit of "learning" which normally produces a greatly lowered cost in the later stages of production, never being achieved.

Finally, the very size and complexity of the aircraft inevitably leads to a large number of modifications which further hamper production.

On the maintenance in squadrons, the situation is correspondingly difficult. Scores of maintenance hours are now being required in many cases to achieve one hour in the air.

Turning to the future, the present trend is that the situation will become still worse as supersonic speeds are achieved.

The size and complexity may be inseparable from the large two-seater all-weather fighters, on which reliance is being increasingly placed in the west. This type of aircraft is primarily developed for nuclear warfare, and it is natural that such a terrible threat should provoke a willingness to adopt even the most complex means if these hold out any hope of defence. Further, such defence must if possible be achieved under the worst possible conditions.

However, this paper discusses the equally important although perhaps less discussed conventional weapon represented by the single seater fighter and particularly the type which has been styled "the air superiority" aircraft—the function of which is:

1. to clear the air
2. to defend its base at all times
3. to strike out at surface targets in association with land and naval forces.

For these purposes a machine is required which is first of all a first-class fighter, and secondly one capable of carrying considerable over-load in the form of ground attack weapons and fuel.

In attempting to bring back at least the air superiority fighter to reasonable size and cost, we ask why there has been this great growth in the other direction in recent years.

It must be realised in the first place, that there is a growth factor of about 7 to 1 on the military load specified, i.e., 1000 lb. military load

requires in the end, a 7000 lb. aircraft to carry it up to transonic speeds; the difference being represented by structure, engine, fuel etc.

A Fresh Start Needed

Naval architects have had to cope with a similar growth in certain classes of vessels, e.g., in the destroyers—in the end the only solution being to make a break in the curves of increasing weight and cost and by getting back to first principles, evolve a new type of vessel, trimmed down to the essentials only.

Such attempts have been made in the case of fighter aircraft but unfortunately these led to inferior performance or unduly limited equipment.

However, there is now a fresh opportunity—the sound barrier for the time being making increased engine power temporarily ineffective in producing higher speeds. There is thus an opportunity to improve in other directions, not only in reducing the size and complexity but also in improving flying qualities, which have not always kept pace with the increasing performance.

Comparison of Large Conventional and Small Fighters

If we summarise the percentage weights attributable to the main elements, we obtain a table as follows:—

Item	*Small Aircraft Percentage of all-up-weight*	*Large Aircraft Percentage of all-up-weight*
Structure	30 %	33/34%
Engine	16 %	20%
Systems	13 %	12/13%
Military Load	21 %	14%
Fuel	20 %	20%
	100 %	100%

One may comment briefly on this table.

Structure

The smaller machine shows a more favourable structural weight ratio despite having an equal range and performance, largely because the small size is in itself more efficient in this scale of machine. There are

a number of simplifying features which can be introduced, such as the unbroken wing, transportable as a spare part in one piece, as compared with the two or more pieces required for the large aircraft, with the consequent joints which are always heavy.

The small wing contains so little volume that it is not required to stow undercarriages or armament, as is normal today.

It should be remembered that these structure proportions are not just estimates, but have been proved by the actual building of the Midge and Gnat aircraft, for comparison with the conventional machines extant.

Engine

The normal thrust/weight ratio of the modern engine is 3 lb. of thrust per lb. of weight. However, these engines are large general-purpose plants, equally suitable for bomber or fighter operation, and they also represent the first generation of the new axial type of engines to go into large scale production.

For these reasons they are much more complicated than the small engines need be, which are specially designed today for fighter operation.

For instance, the number of compressor stages they contain is nearly double that of the specialised fighter engine, which on a short sortie, can afford a 10% sacrifice in fuel consumption to achieve such a large saving in weight bulk cost.

The engine makers have learned much from their early efforts, lessons which will be applied in any case to the next generation of engines, which will however be much longer in coming to fruition if made to general-purpose type. Such a special engine will not need to be expandable, but will have a normal overhaul life, judged by military standards.

It has in fact been found possible to develop an engine of this type which produces 5 lb. of thrust per lb. of weight, and several examples are now actually running, the first being due to fly in the Gnat in a few months' time.

Because of this very great improvement in thrust/weight ratio, the aircraft will be provided with more thrust than usual, even though the percentage weight of power plant has been reduced, so that far from the performance being less than on the competitive large type, it will in fact, be increased, more particularly in the matter of climb and manoeuvrability.

Systems

In maintaining the system weight of the small aircraft equal to that of the large, considerable ingenuity has been needed, together with assistance from the specialist equipment manufacturers, as obviously there are certain items which cannot be reduced at all. However, by using relatively few fuel tanks, a special lightweight ejector seat, by reason of a simple hydraulic system in which each circuit is made to perform more than one function whenever possible (for instance, dive brakes, undercarriage retraction and doors, usually requiring three systems, have been combined in one), and because the small machine requires very much less extensive power controls, it has in fact been found possible to achieve the figures shown.

Electrical gear, often a very heavy item, has been similarly tackled and special lightweight batteries and D.C. generators, to mention only two items, have been evolved by firms of repute.

Military Load

It will be seen that the military load has been allowed to rise from 14% to 21% in the case of the lightweight aircraft, by reason of the savings achieved elsewhere, so that it has become a 50% more effective load carrier from the point of view of the customer.

A reduction of this order, while still maintaining what we claim to be equal effectiveness, is achieved largely by the use of two 30 m.m. guns instead of four. This armament will be adequate for almost any condition or target which can be foreseen in modern war, and it is of course, much more hard hitting than is that comprising four 20 m.m. guns, or six .5 guns, still used in many parts of the world today.

The other sacrifice, which can often be made without any loss of effectiveness, is the use of less channels in the radio sets, together with some simplification in homing equipment.

Radar gun ranging and identification equipment is, however, specified in the light fighter, while there are some items, such as the pilot himself, which are of course, irreducible!

Fuel

It will be seen that there is no difference in the proportion of fuel carried, in that the engine is of slightly higher consumption and also somewhat more powerful in relation to aircraft size.

It could be argued that fuel weight should be increased. However, it is found in jet aircraft that increased power during parts of the sorties actually reduces fuel consumption, e.g., in the matter of climb to a particular altitude, and time saved more than offsets the extra fuel used. Again, during cruising flight, proportionately no more power will be used to maintain a given speed with a very much smaller surface area, which has in fact been reduced about in proportion to the all up weight.

External tanks of a little more than proportionate capacity are provided on the light fighter, and with these fitted, escort radii of action at 500 nautical miles at 45,000 ft. can be obtained for the clean aircraft, or 275 miles radius at 30/40,000 ft. for the tactical aircraft, which is equivalent to about 150 miles at low level.

These radii include reasonable allowances for take off and landing etc. and will be found to compare favourably with the majority of those obtained on the old fighters.

Feasibility

Having, I hope, shown that there is no sacrifice in performance and that in fact the apparent mystery of the small weight is perfectly explicable, I think there is no doubt that military people will agree on the advantages of flexibility, decreased vulnerability, which numbers will confer on those charged with defence.

Of course, the light fighter can be regarded as offering two alternative appeals. Either the same number of aircraft can be used—and if indeed they are equally effective, there will be a great saving in cost, both in charges and maintenance—or alternatively, for the same outlay a considerably larger number of aircraft can be operated.

Certainly experience of the Midge has confirmed the increased flying time which can be obtained when maintenance is simplified.

Cost

Turning to the question of cost, in assuming for the moment that the numbers are equal—the average production hours in England for 200 machines would be about 16,000 for the light fighter and about 48,000 for the conventional type.

However, if skilled labour was the bottleneck, then the productive hours required for 200 heavy fighters would produce 800 light machines.

For the tooling up, only about one-third of the number of jigs and tools would be needed, and these would occupy only about half the time and incur half the cost.

Hence it does appear that a machine has been found to break the vicious circle of size, cost and complexity, which has appeared increasingly to surround those charged with fighter defence.

Conclusion

For India, in her desire to achieve independence of foreign supplies for Defence, I believe the light fighter offers the right solution. With only a moderate degree of help from specialists it should be possible to make here progressively both aircraft and engine, and the engine we have discussed could power all the essential aircraft likely to be needed in the foreseeable future.

DISCUSSION

Air Commodore P.C. Lal: What are the implications regarding the manufacture of light fighter aircraft in a country which is industrially not developed? How does this compare with manufacturing possibilities in, say, England?

The Lecturer: My opinion is that partnership between a developed country, say in a European area and a country not so well developed, will be necessary to achieve the best results. Such partnership is possible, and if that can be accepted great things can be done, provided it is in the capacity of the country to do so, and in this connection the light fighter offers possibilities not otherwise available. As regards a complete home industry, a much longer period for building up would be required here than in the West. More advanced techniques require that new skill is needed just about as fast as it can be learnt. One should therefore, not only build up administration and scientific background but also engineering management and technical skill, which I think can only come from partnership and experience.

Air Commodore Arjan Singh: Would the engine to be used in the Gnat be capable of development of higher thrust, without increase in weight or size?

The Lecturer: It is an important question. There is no fundamental reason why this small engine should not develop higher thrust without corresponding increase in weight or size, and this is in fact

envisaged. There is scope for much development in this engine for the next ten years.

MAJOR-GENERAL J.N. CHAUDHURI: I seem to remember reading somewhere that there were about eleven designs put up in a N.A.T.O. competition for light fighter aircraft. If this is correct, could you say what is the difference in these designs—on what lines the other designers are thinking and what progress has been made ?

THE LECTURER: Various designs were put up by several countries, France, Italy and England included. So far, none of them has been accepted, partly for technical reasons. The specification envisaged also, did not come up to a satisfactory standard in the view of some of the experts concerned. All I can say as regards the aircraft of other countries is that they are, without exception, on the drawing board, and we have more than 2 to 3 years start over them. Also light fighters are not easy ! Of all the aircraft I have designed, the Gnat has been the most difficult. Simplicity is harder to achieve than complication, and it is very difficult to produce a good light fighter.

GROUP CAPTAIN E.W. PINTO: A straight-through air intake on the jet engine is supposed to be the most efficient. I understand that American and French designers have adopted the straight-through air intake, whereas British designers still believe in the side air-intake. Why is this so ?

THE LECTURER: Not all American designers have adopted the straight-through air intake and extensive trials have been going on there and in England. The findings have been that, in fact, for transonic aircraft, the side air intake is as good, if not better. The straight-through air intake is I think a requirement in supersonic aircraft flying in the region of Mach 1.5 and above.

GROUP CAPTAIN RANJAN DUTT: In the consideration of any aircraft, range to us is one of the most important factors. The Gnat carries 150 gallons of fuel whereas a standard fighter carries as much as 500 gallons. Furthermore, the specific fuel consumption of its engine is likely to be high. Yet the claim has been made that the Gnat has the same range as a standard fighter. How do you reconcile this?

THE LECTURER: The Gnat is only a third of the weight and drag of the standard fighter, so its basic power need is only about one-third. Also the thrust/weight ratio of the Gnat is better than that of standard

fighters, which actually means less fuel for climb. In addition, the long range tanks installed in the Gnat carry proportionately more fuel than the long range tanks of the standard fighter, expressed as a percentage of the all-up weight. For all these reasons the 10% increased fuel consumption of the Orpheus engine still leaves the Gnat with a competitive radius of action at both high and low level.

LIEUT. COLONEL H. S. KANDHARI: In a fast moving battle, will the light fighter complicate the provision of airfields from which to operate, in close support of the land forces ?

THE LECTURER: The light fighter, as compared to the current normal fighter, e. g. Vampire, is in this respect approximately of the same performance. Compared with more modern fighters with high tyre pressures, demanding concrete runways, it is much better.

GROUP CAPTAIN M. S. CHATURVEDI: Is it correct that guns in the aircraft are being replaced by air-to-air guided rockets, and if so, will the light fighter be in a position to carry the latter?

THE LECTURER: I do not think that air-to-air guided rockets will come into use so soon.

GROUP CAPTAIN M. S. CHATURVEDI: Say in five years' time? If these rockets come into use and if the light fighter cannot carry them, will this aircraft then become out-moded?

THE LECTURER: I consider that the air-to-air guided rockets may be used in about five years' time, in limited areas. I do not consider that they will be in general use within that period. In any case this aircraft can carry certain types of guided missile, about which I cannot give details because they are still on the secret list.

COMMANDER V. A. KAMATH, I.N: If a navalised version of the Gnat is produced, does the lecturer consider that it will retain its many great advantages, envisaged at present, as a light fighter? The reason I ask this particular question is because I am not certain whether, in a very light plane, such as the Gnat, the increased weight resulting from navalisation will not seriously affect its performance characteristics.

THE LECTURER: The Gnat can be adapted as a naval light fighter without very serious penalty. The arrester gear on the carrier will have to be adapted to suit this plane.

THE CHAIRMAN: We have just heard a very interesting talk from Mr. Petter on the Light Fighter and its contribution to air defence. I think it will be quite impossible for me, nor is it necessary, to sum up the talk

in any detail, but I would however like to emphasise, perhaps re-emphasise, some of the general points.

The first one which occurs to my mind is the simplicity of the aircraft; simple to fly, simple to operate and simple to maintain. As a pilot, I can speak with some knowledge on this advantage of simplicity. An aircraft which is simple to fly is obviously a big advantage. I would say, that in maintenance, if you could cut down on the man-power required, it would result in a big saving. As for operating a light-weight aircraft you probably would not have to go in for airfields requiring long runways.

The aircraft for our needs should be a multi-purpose aircraft. Most of the superior conventional fighters are tending to become pure interceptors, and for a country like ours that is a luxury which we may not be able to afford for a long time. When we talk of air superiority, we have got to bear in mind that it is perhaps a passing phase. Generally speaking, one has to maintain air superiority, but when it is achieved, it would require lesser effort to maintain it and therefore a larger number of the aircraft can be spared to operate in support of the other Services, particularly the Army.

Another important consideration is that the aircraft should be able to operate from readily prepared forward airfields. If very extensive airfields with good hard surface are required, then by the time these airfields are ready, the battle scene may have shifted. Therefore it is necessary that this aircraft is capable of operation from easily and hastily prepared airfields.

Lastly we should cut down the administrative tail, which appears to be growing in all the three Services. In the case of the bigger aircraft, you want more fuel to operate from the forward airfields, more spares, more men, more rations for the men and so on; in fact, more of everything in a bigger way, and if you can cut that down, I think you will have achieved something. This cutting down of the administrative tail applies, of course, to all the Services, and I am sure that all of us are thinking about it.

Another point which has occurred to me just now and strikes me as important is the initial cost—I do not see any financiers here——which is a big point for a country like ours. I think if we can get something which will serve the required purpose at a lesser cost, that in itself will be a big consideration.

I would now like to thank Mr. Petter and, I am sure, you will join with me in doing so, for giving us a very interesting talk this morning. (*Applause*)

A LOOK THROUGH A WINDOW AT WORLD WAR III*

FIELD-MARSHAL THE VISCOUNT MONTGOMERY OF ALAMEIN, K.G., G.C.B., D.S.O.

I SPEAK today as an international soldier who is the servant of the 14 Governments of the N.A.T.O.

If we are to make progress in keeping up-to-date, it seems to me that some statements must be made by responsible Service Chiefs that are more precise than those that have been made in recent times.

What I have to say represents my own personal views and I hope it will be regarded as a contribution to constructive thought on defence problems.

THE COLD WAR AND THE HOT WAR

I would ask you to note the title of this lecture:—

"A look through a window at World War III."

Some may say that World War III is already in progress and that, as usual, it has taken a different form from any other war. It has come to be called the *cold* war. It might well have been called the 'cold peace.'

As we advance further along the road of development of atomic and thermo-nuclear weapons, guided missiles, and ballistic rockets, it will become increasingly clear that a *hot* war will be mutual suicide for the contestants. Therefore, the great problem regarding the cold war now in progress is how to win it without precipitating a hot war.

Local wars, *e.g.*, Korea, Indo-China, Malaya, Kenya will no doubt continue to form part of the cold war, but there is a vast difference between them and a hot war. Both are global, the cold war *and* the hot war. In trying to win the cold war one side or the other may miscalculate and bring on a hot war, though neither side wanted it.

I consider that the present state of world affairs, and the present tension, will continue for a long period. Therefore, the true objective of all

* Lecture reproduced from the RUSI Journal by courtesy of the Royal United Service Institution and Field-Marshal Lord Montgomery (*Ed.*)

military thinking today must be how to combine most economically the military measures needed for success in the cold war, with the development of the military strength needed to convince our enemies that a world hot war would result in their own destruction: no matter how great the surprise they achieved at the outset, nor how ruthlessly they conducted the contest.

The cold war calls for the use of conventional weapons; success in the hot war calls for new weapons.

It is obvious that the use of atomic and thermo-nuclear weapons will have a profound effect on the conduct of war, on weapon systems, on strategical and tactical conceptions, and therefore on the organization of forces.

In our reorganization, we may often find a clash occurring between conventional weapons which we know about, and new weapons which we do not know about. Whenever that clash occurs, the solution should be on the side of the long-term new weapons. New weapons must be 'phased in' gradually to our existing weapons systems so as to reduce, or eliminate progressively, equipment and weapons which will become out-of-date as the years pass.

I want to make it absolutely clear that we at S.H.A.P.E. are basing all our operational planning on using atomic and thermo-nuclear weapons in our defence. With us it is no longer: "They may possibly be used." It is very definitely: "They will be used, if we are attacked."

The reason for this action is that we cannot match the strength that could be brought against us unless we use nuclear weapons; and our political chiefs have never shown any great enthusiasm in giving us the numbers to be able to do without using such weapons.

It all calls for a certain reorganization of our forces, and in our strategy.

A special group at S.H.A.P.E. has had these matters under very close examination for the past year and we have reached certain conclusions. We now need the co-operation of national authorities to get those conclusions translated into practical action.

In fact, we have reached the point of no return as regards the use of atomic and thermo-nuclear weapons in a hot war.

CIVIL DEFENCE

If we visualize an atomic war, the importance of Civil Defence is apparent. That subject is grossly neglected today. Indeed, there is no

sound Civil Defence organization in the national territory of any N.A.T.O nation so far as I know.

The immense destruction caused by atomic and hydrogen bombs, and the disposal of large numbers of civilian casualties, could not be handled by a few volunteers. It would be a gigantic task.

Trained and disciplined men under good leaders would be required, over and above any civilian organization that existed in peace.

Since nuclear attack is now a possibility, a nation must be able to absorb a surprise attack, and survive to continue the struggle. Therefore the whole framework of the Civil Defence organization must exist in peace, with a Chief of Civil Defence and the essential means to implement the plan.

Unless the framework of some sound Civil Defence organization is set up in peace, a nation will face disaster in a world war: since the home front will collapse.

THE FUTURE

In our thinking ahead we need some realistic foundation.

Let us therefore consider a war between two powerful groups of nations, and let us call them East and West. You can make any grouping within this broad statement that you think suitable. I would suggest we include the N.A.T.O. nations in the West.

We will assume that the West has at present a superiority in atomic and thermo-nuclear weapons together with the means of delivery, but that as the years pass that superiority is likely to decline.

It was Maeterlink who said:—

> "The past is chiefly of use to me as the eve of tomorrow.
> My soul wrestles with the future."

Let us then consider the future.

General Approach

If ever war should come again to this distracted world, which God forbid, weapons of power unprecedented in the annals of war are available for employment. There are some who say that if war is joined, nuclear weapons will not be used; I would disagree with that. My opinion is that the fear of atomic and thermo-nuclear weapons is a powerful deterrent to war; but once a world hot war has started *both* sides are likely to use

them. We would certainly use them ourselves if we were attacked, as I have said.

So far as we can see today we are not justified in depending on air bombardment alone, even with nuclear weapons, to bring a world war to a successful conclusion: still less a local war or disturbance. Wars today can be won only by fighting, and in a hot world war, fighting will continue in the air, at sea, and on land until one side loses the will to fight on. We would be wise to accept these facts and to prepare ourselves accordingly. Those who are inclined to believe that future wars will be confined to push-button activities would do well to stop deluding themselves.

On the other hand, the skilful employment and accurate application of superior nuclear fire-power *in combination* with the operations of streamlined land forces, can be a decisive factor in the land/air battle. The problem will be, how to force the enemy to concentrate his armed forces sufficiently to offer a worth-while nuclear target, without exposing our own forces to destruction by the enemy's nuclear attack.

In our forward thinking we must put the emphasis on organization, on tactical conceptions, and on the weapons and equipment that are necessary to enable us to fight in the way we want.

All our future depends on getting the right answers to the problems we now have to face.

The Hot War By Miscalculation

If a hot war is precipitated by miscalculation, which is always possible, there will not have been the build-up of Eastern land and air forces, nor the strategical deployment of submarines, which are generally taken for granted. In such a case, we, the Western nations, might be temporarily surprised.

But if we can react quickly, we would win such a war.

It would take a long time for the East to build up the forces necessary to do us serious harm, and by that time our air forces will have done a great deal of damage to the Eastern countries.

This type of hot war, the war by miscalculation, may come at any time. We must fight it with the weapons we have got, and in the way our forces are trained when it begins. We must, in fact, do the best we can

with what we have got, and *not* be tied to plans designed to meet an entirely different situation.

The Deliberately Planned World Hot War

I suggest that such a war will have three phases.

First Phase: a world-wide struggle for mastery in the air and of the oceans. It will be vital during this phase to prevent enemy land forces overrunning and neutralizing Western bases and territories.

Second Phase: the destruction of the remaining enemy land forces.

Third Phase: the bargaining phase, when the enemy's homeland and all it contains is at the mercy of the Western air power. We will then carry the air attack to the point where the enemy accepts our terms.

The second and third phases may be concurrent.

Against the background of this overall strategy, let us consider the war under three headings:—

The War in the Air.
The War at Sea.
The War on Land.

THE WAR IN THE AIR

It is clear from the strategy I have outlined that the dominant factor in future war will be air power. And that is my very firm belief. But like so many things we do we too often pay only lip service to this great truth.

The greatest asset of air power is its flexibility. The main factors in determining the degree of flexibility are the methods of command and control, the range of aircraft, and the mobility of supporting equipment. Flexibility and centralized control of *all* the air forces in a theatre of war are vital to success.

But the West has sacrificed flexibility by basing the air command organization on the requirements of 'direct support' of the land forces, whereas it should be based on the organization necessary to gain the greatest measure of control in the air.

Air power is indivisible. If you split it up into compartments you merely pull it to pieces and destroy its greatest asset—its flexibility.

If we lose the war in the air, we lose the war and lose it quickly. The methods we adopted in the later stages of World War II are not *necessarily* those we should adopt in the next war. In World War II we had almost complete air superiority from 1943 onwards ; it will not be the same in World War III, and we cannot afford to sacrifice flexibility in our air command organization.

We must be careful that we do not draw false lessons for the future from the last two years of the late war : by which time we had won the war in the air.

The land-based air forces must always provide whatever offensive air support is needed in the war on land, using air forces that are highly trained in that particular work. But they must carry out this task without sacrificing their own flexibility. On occasions the whole of the available air power may have to be used to help to save the armies from destruction, and the air organization must provide for such a contingency arising at short notice.

Now let us examine the war in the air.

If we can maintain the ability to start a tremendous nuclear bombardment of the East *the moment we are attacked*, they cannot afford to do nothing about it.

It *must* affect the employment of their air forces.

It *must* force them to devote a considerable effort of their long-range air forces and nuclear weapons to attempt to hit *our* strategical air forces and the installations on which they depend.

It *must* force them to expend effort on air defence, no easy problem for them.

Against this background, I suggest there are three successive stages to consider in the war in the air.

The First Stage

This stage would be if war comes in the near future.

In this period, as I see it, both sides will rely principally on *piloted* aircraft in both the strategical and tactical fields. In this period also,

we stand to gain from the balance in favour of the *offensive* in the air, if we can react immediately we are attacked.

I see no sign, within this period, of either side being able to create an air defence system which could greatly affect the present balance in favour of the offensive in the air.

The results of this great battle for mastery in the air will have a tremendous effect on the whole war, and we must win it.

But we cannot afford to rely on air resources which depend on mobilization. The air forces we need, together with all the means necessary to keep them operational, must exist in peace-time. And we must restore to the air forces the flexibility they have largely lost, by centralizing Air Command on the highest possible level.

The Second Stage

In the not-too-far distant future, the East may create a sufficient stock of atomic weapons, and may develop the long-range means of delivering them, effective enough for them to strike at the outbreak of war a devastating blow at *our* means of delivering offensive air power. We would not then be able to apply our greater stock of nuclear weapons, and we might therefore lose the initiative in the air war at the start.

At this stage, as far as I can see, both sides will still be relying principally on piloted aircraft, both for offence and defence.

Before this period arrives, it will be of tremendous importance that we should have developed, and have in being, a highly effective global early warning system, together with the best air defence that the scientists can give us: in order to prevent our offensive air power being crippled from the start by a surprise attack.

The Third Stage

Later on still, further ahead in my opinion than five years from now, the East may have developed means of delivering their weapons with accuracy, both short-range and long-range, which do *not* rely on piloted aircraft. Our ability to counter that threat by both offensive and defensive measures will be much reduced, because the targets will be far less vulnerable—whether they are launching sites, or the weapons themselves actually in the air.

We must ask ourselves seriously what, at that stage, are to be the targets of our offensive air power. Will it then be true that offensive operations by *our* aircraft or missiles will directly affect the enemy's ability to deliver *his* weapons against us ?

I do not see the aeroplane disappearing altogether.

In the tactical field I am sure that there will always be tasks for piloted aircraft in support of land and naval forces. The enemy's aircraft used for these purposes, and their bases, will remain an important target for our aircraft and missiles.

Conclusion : The War In The Air

What are the conclusions ?

Once we have solved the problem of endurance in the air, and an aircraft can remain in the skies for prolonged periods and in all weathers, then air power will be the decisive factor in warfare. That time is not yet ; but it will come.

What we must do *now* is to organize the command and control of our air forces so as to retain the greatest degree of flexibility, centralizing command in the highest commander who can effectively exercise that command so that he can wield the available air forces in a theatre of war as one mighty weapon.

If we are attacked, we must set in motion an *immediate* air offensive on the largest possible scale, directed at the enemy's air forces and at his homeland.

The means of delivering an immediate air offensive *must* exist in peace.

We must develop an effective, and global, early warning system in order to have some chance of being able to take the offensive in the air should we be attacked. And we must study air defence urgently : I will say something on this subject later on.

It is vital that our air forces should be able to absorb nuclear attack, and survive to strike back. The principle of dispersion must be explored from every angle. We must get away from the enormous concrete runways of today, and develop aircraft which can land and take off from small P.S.P. airstrips dispersed over the countryside. This would have a

revolutionary effect on infrastructure and result in very great savings of money. In this respect 'vertical lift' aircraft have very great possibilities.

THE WAR AT SEA

Now let us discuss the war at sea.

No modern development has lessened, or is likely to lessen in any foreseeable future, the dependence of the Western nations on the movement of their means of existence across the oceans of the world: in war, or indeed in peace.

For instance, in an East-West war, it is my view that the West could not win if it lost control of the Atlantic. If we cannot deploy in Europe the power of the American continent, Europe could fall.

In the open seas the great threats are the submarine and air attack. In the narrow waters, the threat of the mine must be added and attack by aircraft will be more effective.

The first task of the Western naval forces is to make certain that they can deal with any challenge to our control of the seas, and that we do *not* lose that control.

Naval forces require air support in the same way as do land forces. It is vital, *in the conditions of today*, that navies called on to operate in the great oceans should have *their own* air forces.

The navies of those nations whose work *lies entirely in narrow seas* such as the Mediterranean, or in European waters, are in a different situation; in my view, such navies do not need their own air forces.

What I have said about the war at sea is applicable today and for the next few years. But the more one considers the future, the more the problem of control of the seas becomes difficult to foresee.

The question to be faced, and decided, is:—

"In the future, will the seas be controlled from the sea or from the air?"

When one considers the range and power of aircraft of the future, and the progress that is likely in radar and electronics, I am personally forced to the conclusion that the time will come when the major factor in the control of the seas will be air power.

It seems to me that the day of the large warship on the surface of the sea is over. The emphasis in the future is likely to be on the smaller type of vessel and on underwater craft.

If it is true that the seas will in the future be controlled mainly from the air, then it is for consideration whether this control would not be best exercised by national air forces and *not* by naval forces. If this is the case, then navies will not in the future require their *own* air forces. That time has not yet come. But in my view it will come eventually. If this is true, then we should not build any more expensive aircraft carriers.

Until the future is clear in this respect and a decision is given, navies should not be allowed to build independent shore-based air forces designed to carry out, and duplicate, the present maritime responsibilities of Coastal, Bomber, and Fighter Commands of a national air force: such as the Royal Air Force of the U.K.

What it amounts to is that new weapons have not yet rendered the aircraft carrier obsolete, but they are likely to do so in the future. And I see control of the seas eventually passing to air forces.

THE WAR ON LAND

To fight successfully on land we need the following four essentials as a minimum:—

First. We must have first class 'active' peace-time forces, up to strength and ready at all times to act as our shield *without any mobilization procedure.*

These forces must be trained and equipped to the highest pitch: mobile, hard-hitting, offensive troops of magnificent morale, very highly disciplined, under young and active commanders. These are the troops and the commanders who have got to stand firm in the face of the horrors and terrors of the opening clashes of an atomic war, and they will stand firm only if they are highly trained and highly disciplined.

These are the M-Day forces.

Second. We need reserve forces, well organized, capable of being mobilized in echelons, and each echelon receiving sufficient training in peace to ensure it is fit to fight at the time it is needed.

These are the Post M-Day forces.

Third. Our forces, active and reserve, must be backed by a sound logistic and movement organization, which should exist in peace to the degree necessary to ensure success in the opening weeks of war.

Fourth. We must have a sound Civil Defence organization in each national territory.

The whole philosophy underlying these needs in land forces is that the active forces 'in being' in peace will make it impossible for the East to launch an attack successfully *without a preparatory build-up of their forces*, which we would know about ; it would be difficult for the enemy to surprise us.

Our *active* forces will prevent the Eastern forces from reaching our vital areas, while we are assembling and moving forward our *reserve forces*.

GENERAL SUMMARY

It is clear to me, and I hope to you, that adequate air strength, multiplied by the ability to use nuclear weapons in quantity, increase our chances of successfully defending the West if we are attacked.

A further point is the great effect that the progress of science may have on the time factor in war. There is a stronger requirement now than ever before for M-Day forces to be ready, in place, and fully effective against a surprise attack.

Reserve forces must be organized with relation to the time when they must be available for use. This will affect the state of readiness in which they are maintained, and, to some extent, their organization and equipment.

It seems to me that the early phases of a third world war will shape very rapidly the course of such a war. It would be wishful thinking to say at this time that a decision would be reached in a matter of weeks or of a few months. But I suggest to you that a policy of the fullest exploitation of nuclear weapons *early in a war* raises serious questions as to the military worth in peace-time of contributions to the war effort which will have a delayed effect.

Let us have a last look at the war in the air, at sea, and on land.

The War in the Air

We have got to win the war in the air.

We will not win it unless the air forces are allowed to regain their flexibility and unity, and unless air command is organized accordingly. *It is vital that this matter be tackled at once on the highest political level.*

We *must* maintain in peace the ability to launch an immediate offensive in the air against anyone who attacks us.

The West is vulnerable to nuclear attack. Great offensive power is wasted unless it is married to defensive power and can be launched from a secure base. As time passes and the offensive capability between East and West levels out, the advantage will go to that side which has the greater defensive strength, which can protect itself against attack, and can survive to strike back.

There is at the present time no sure defence against the aeroplane or ballistic rocket. Indeed, so far as we can see today, trying to get a secure defence against air attack is rather like trying to keep the tide back on the sea shore with a picket fence. This situation must not be allowed to continue.

The best scientific brains we possess should be gathered in to help in the task, working in close co-operation with air forces. I say 'air forces' because I hold the view that air defence should be organized and handled by air forces, and the A.A. Commands should be handed over to that Service.

The War at Sea

If the armies can hold the land flanks, they help to keep the threat to manageable proportions.

Today, the navies must handle this war. They must be given the minimum means to ensure control of the seas and of the approaches to essential ports, and no more. It is essential that they should not dissipate those means on *tasks which do not affect the war at sea.*

But we must not be hide-bound by past traditions. I give it as my opinion that the time will come when the seas will be controlled from the air. If this is true, the future must be planned and organized accordingly.

The War on Land

Of all the fighting Services the armies have the most difficult task as regards organization for the future.

We must make a serious study of the shape of future war on land. It is of little use to superimpose new weapons on World War II organizations, and then to try and work out the tactical changes involved; we have got to examine the problem against a new background.

We must examine our armies, and their equipment, to see what changes are needed in an atomic age. A complete reorganization is needed of the reserve armies of all the Western nations ; the present systems for producing reserve armies are mostly out-of-date.

In the organization of land forces the emphasis must be on strategical and tactical mobility, and on simplicity of weapons systems. We need divisions that can be moved rapidly by air ; this will necessitate suitable aircraft for the purpose.

To gain full advantage of the immense fire-power that nuclear weapons have provided, and to avoid destruction by enemy nuclear attack, armies must develop a more lively and opportunist type of battle leader than exists at present, in both junior *and* senior ranks. Such a leader must have the imagination, the daring, and the resources to seize fleeting local opportunities ; he must be trained to act independently and immediately within the frame-work of a general plan, rather than on precise and detailed orders or only after reference to a superior. I should add that these qualities in a leader apply equally to navies and air forces.

Land forces must become *less* dependent on roads and *more* capable of cross-country movement.

The supply system of land armies must be streamlined. They must become much less dependent on fixed lines of supply such as roads and railways, which involve frequent transfers of load.

Armies need a simple line of supply based on an air lift. Today, when suppply lines are cut by enemy action, armies cease to operate efficiently.

The system of the future should provide air supply to forward maintenance areas from base depots many miles to the rear and well dispersed. Divisions would draw their requirements from the forward maintenance areas with vehicles having a cross-country capacity.

The air lift from base depots to forward maintenance areas must be by some type of ' vertical lift ' aircraft, which can take off and land vertically, and which fly at a fast speed like an ordinary aircraft in level flight. The air supply must be capable of being maintained in *all* weathers, and by day and night. Obviously, the distance for this forward air supply should be kept as short as possible ; therefore base depots should be moved forward from time to time.

I see base depots being replenished by large freight-carrying aircraft which can land and take off from P.S.P. airstrips.

There is clearly a tremendous future for 'vertical lift' aircraft and it must be exploited for the benefit of land forces.

Whether this supply organization should be owned and operated by armies or by air forces is a matter for immediate examination on the highest inter-Service level. Finance will affect the solution.

No nation could afford to give to one Service the amount of air lift that Service would need at any particular peak moment in war. In the Berlin Air Lift, and in Korea, it was necessary to draw on the air transport resources of *all* the Services.

If the air lift organization is to be an organic part of an army, it will cost more than if it was under the air forces; and the army will never have enough.

In war-time, great flexibility will be needed, and the ability to effect rapidly a large concentration of air lift within a theatre of war will be necessary. Great skill will be needed if the lift is to be maintained in all weathers. Air cover and protection will be necessary. An air lift organization must be dove-tailed into air operations; you cannot separate an air transport system from air operations.

A political decision will probably be necessary as to who will man, own, and operate the air lift for land forces. That decision should be given soon, and before an inter-Service argument develops which could lead to ill-feeling. It is my opinion that this vast air organization for the land armies will be best handled by the air forces, for the reasons I have outlined.

Such a supply organization would do away with the vast array of units and headquarters which today constitute the enormous 'tail' of a modern army. It would be the first step in restoring to armies the 'freedom of the countryside,' and the tactical mobility, that have so largely disappeared. By simplifying the tail we shall get more bite in the teeth.

The armies of today have to a large extent lost their mobility; they are becoming road-bound and are weighed down by a gigantic administrative set-up in and around them. Staffs are far too big; the amount of paper that is required to produce even quite small action is terrific. We seem to have lost the art of command, other than by paper. No ordinary

man can read half the paper that is in circulation ; I doubt if the other half is worth reading.

All this must be tackled ruthlessly.

It is clear to me that the next world war on land will be very different from the last one ; we shall have to fight it in a different way. In particular, we must ensure that our scientific and engineering development is applied in the right way. We must not use it to develop existing weapons to be more efficient for use in conditions which have passed and will not recur.

THE GIST OF THE WHOLE MATTER

Among the Western nations our policy must be:—

Strength through unity.

Peace through strength.

But we must understand that the danger of war is always with us because the fundamental aims of the two sides, East and West, are in direct conflict. If war is joined, and it becomes general, then nuclear bombardment would become general between the contestants.

A study of war reveals a thread of relentless change.

In fact, *change* is inevitable from time to time, and it looms ahead of us today. But *progress* is not inevitable.

Progress depends on sound decisions, and then on action. Those decisions must be made now, and the action ordered.

We stand today at the cross-roads, not knowing which turning to take.

Absolute defence against air attack will be impossible in the future. A deterrent, the means with which to hit back instantly and to give more than you receive, is the surest way to make an aggressor think twice before he attacks. The West must build up such a deterrent, capable of being delivered immediately through the air.

It is then vitally necessary to guard against a surprise attack, and against treachery, and to be able to hold such an attack long enough to enable nations to spring to arms behind the shield and mobilize their collective strength.

The Western nations must also retain the ability to absorb atomic and thermo-nuclear attack, and must ensure that their means of instant retaliation are not compromised by surprise or treachery.

Now, as never before, real preparedness is vital.

The nation that can organize itself properly in peace as regards its manpower, its production, its armed forces, and its Civil Defence, and can turn over easily and quickly from a peace to a war footing, taking the emergency in its stride and riding the storm easily—that nation will gain the initial advantage, and will win.

In spite of everything I have said, I would issue a most definite warning against rushing into major changes until we are certain that they are sound.

What is needed today in every nation is a roll of drums and a clarion call. That call must be one to discard out-of-date doctrines and methods, and to organize our affairs to take full advantage of the progress of science.

In particular, I would draw the attention of all National Chiefs of Staff to a verse in the New Testament, First Epistle of the Corinthians, which reads as follows:—

"If the trumpet give an uncertain sound, who shall prepare himself to the battle." (I *Corinthians*, 14, 8.)

We need a clear and 'certain' sound, on an inter-Service key.

On the subject of inter-Service relations and co-operation in the international sphere, I would say this: there is room for much improvement. Before the late war the activities of the fighting Services were largely unco-ordinated, in the U.K. at any rate. During the war inter-Service co-operation reached a high standard. Since the war it has deteriorated. In some nations it is good; in other nations it is bad.

We talk about the need for international unity and co-operation; we can hardly expect it if we ourselves do not give a lead with good inter-Service co-operation.

Political, financial, and economic considerations will make it impossible for armed forces to have all they want, or do all they would like. It will become more important than ever to concentrate on essentials and to have our priorities right.

In the scientific age into which we are moving, which is also an age of ever-increasing costs, Governments have got to ensure that their armed forces and security measures are built up within a framework of economic realities and against a background of sound inter-Service responsibilities.

BALANCE OF FORCES

If what I say has validity, then the future will call for:—

(*a*) Bigger air forces.

(*b*) Smaller and more immediately-ready Regular armies with great strategical and tactical mobility. Better organized and more efficient reserve armies.

(*c*) Smaller navies.

(*d*) The organization of the three fighting Services based on more atomic and thermo-nuclear power, and less manpower.

(*e*) A Civil Defence organization which exists in peace to the degree necessary to ensure it can operate in top gear in an emergency. It must be understood in this respect that while great destruction may be caused at the point of burst of a nuclear weapon, tremendous saving of life and property will be possible on the fringes.

The overall aim should be to get financial expenditure on defence geared to a level which will carry a reasonable defence budget over a prolonged period of years: thus giving continuity and stability of planning.

CONCLUSION

I do not imagine for one moment that all present here today will agree with everything I have said. My objects will have been achieved if during the course of this address I have been able to make some contribution to constructive thought on a problem which affects the security of the Western world.

I would like to put a few points to you in conclusion.

First. In the Navy, the Army and the Air Force we have a team. By themselves the individual members can achieve little. The team can achieve victory. The progress of science is likely to change the former responsibilities of the three members in certain directions. Parts of the load are shifting from the shoulders of one Service to the shoulders of another. In particular, the air is coming to the front as the dominant

factor in war, and the decisive arm. This is going to introduce difficult problems, and in solving them do not let us bother unduly about the colour of our uniform: khaki, dark blue, light blue.

I suggest to you that there are two factors about air power which affect the issue:—

(1) How best to use the mighty weapon of air power so as to win the war quickly. This will call for a high degree of centralization.

(2) How to ensure that the air will play its full part in the team. This calls for decentralization.

These two factors may seem to conflict. I do not myself believe that they are conflicting and I am certain that the answer can be found. Indeed, it must be found. And the important point is to reach the right answer without ill-feeling and inter-Service quarrels.

Second. I have forecast greatly increased responsibilities for air forces.

Today, it is doubtful if the air forces could cope with those added responsibilities.

If what I have said is true, then the air forces must be got ready over the years to handle the tasks that will fall to them.

Third. We spend today enormous sums in scientific research and development. But new weapons and technical equipment will avail us little unless we have first-class officers and specialists to operate and maintain them.

All the fighting Services are below establishment in Regular personnel and technicians, more because of the 'conditions' of service than because of inadequate pay.

Would it be a good thing to get a better balance between the two requirements of scientific development and skilled personnel, since both are essential?

In other words, should we spend a little less on scientific development and more on improving the conditions of life in the fighting Services?

Fourth. The mobilization systems of today need drastic overhaul. Most of them look archaic against the background of nuclear warfare, being far too leisurely.

The mobilization system of an atomic age must be such that on national radio warning it is effective in a matter of hours rather than days ; it must be based on a decentralized method of call-up and dispersed equipment depots ; it must be founded on a body of reservists all of whom know in peace-time exactly what to do on mobilization, and are able to do it quickly.

Fifth. Civil Defence must be moved up to take its rightful place in the national war machine. In my view, the team of three—Navy, Army, Air—has now become four, Civil Defence being the fourth member.

STRIKING FORCE

Major V.P. Naib

IN the two previous articles entitled "Close Support" and "Tank versus Tank Battle",* the current ideas on the employment of artillery and armour were critically examined with particular reference to Indian conditions. Having drawn useful conclusions on the integrated use of infantry, armour and artillery in battle, it will be profitable to discuss some aspects of organisation and equipment as well. Unless a nation's armed forces are organised to contain the correct proportion of the various arms and are equipped with weapons at least similar to the ones they are likely to fight with, they cannot be trained properly. Without proper training, we cannot learn the technique we will use in war. Considerable forethought in planning its organisation and equipment, and its training in the correct techniques, are essential before any army can assume its war-time responsibilities smoothly and efficiently. As the main striking element of a mechanised army is armour, the scope of this paper is restricted to a discussion of the necessity for an Armoured Striking Force in a country like India and its organisation and equipment.

The Need For a Striking Force

During peace, a nation's military organisation should be geared to such a degree that it can always provide a Striking Force which is capable of taking the field at short notice and carrying the war into enemy territory. The old British concept of the regular army, withstanding the initial shock of the enemy's offensive and carrying on a war of attrition to enable the preparation and mounting of a counter-offensive, is basically a wrong concept of war and particularly unsuited to modern conditions. This is quite apart from the influence of thermonuclear weapons of mass destruction on the general pattern of war. In the present international set up, the cold war between the two power blocs generates minor limited wars like the Korean and the Indo-Chinese wars. The atomic weapons, while acting perhaps as a deterrent to a total world war, are no bar to minor

* The author's articles on "Close Support" and "Tank versus Tank Battle" were published respectively in the Armoured Corps Journal (July-December 1953) and the USI Journal (July 1954).

aggressions. In such wars the aim of the aggressor is speedy victory, so that he can present the world with a "fait accompli" and argue later.

One needs only to pick up at random any of the reported debates at the United Nations to realise that these days, any act of aggression can be justified on the grounds of national or regional security. The dividing line between national or regional strategy and naked militarism is wearing very thin indeed ! Therefore, the military organisation should be such that the moment national security is threatened, it is capable of striking first and striking deep into enemy territory. An offensive war, which should be distinguished from an aggressive war, is the best way of safeguarding national security. To be on the defensive and wait for the enemy to attack is to invite disaster.

The foregoing considerations postulate that national security is best safeguarded by having in readiness a properly organised and adequately trained Striking Force for an offensive war. During peace there is a tendency to overlook this aspect of the problem. As a consequence of this, war invariably forces constant shuffling and reshuffling of units and subordinate formations resulting in confusion, waste and loss of efficiency. Sometimes this state of affairs is sought to be justified in the name of flexibility of peacetime organisations. But in reality, the principle of flexibility, so essential in war, is apt to be conveniently interpreted to cover lack of vision and lack of planning during peace. It is admitted that a democratic polity, by its very nature, imposes certain limitations on military planning. But the very process of military planning is designed to overcome such limitations as are inevitable in the achievement of anything concrete and worth while.

Waste and inefficiency, which are the fore-runners of disaster, can be avoided if we are clear in our minds about the technique of war we should adopt, in order to win a war that may be forced on us. As already stated, the aim is to carry the offensive deep into enemy territory for seizing strategic objectives which will cripple the enemy's war potential. This will mean organising a striking force which can fight a battle of manoeuvre, with perhaps similar enemy forces. In such a force, though armour predominates, there must be an adequate proportion of infantry and artillery to form firm pivots of manoeuvre as well as to support armour. As the technique of armoured mobile warfare has already been discussed at length in the two preceding articles of this series, I shall not go over the old ground

once again. I shall, therefore, proceed to consider the broad aspects of the composition and requirements of the Striking Force.

Composition and Requirements

For the purposes of illustration let us assume that the peace-time strength of the Striking Force is equivalent to one corps consisting of three divisions. The requirements of a force of this strength for carrying out its allotted tasks are: it should be hard hitting, completely mobile and capable of moving with speed. These requirements are best met by having two of the three divisions armoured and the third, a motorised infantry division. Such a proportion of two armoured divisions to one infantry division is necessary, because, with only one armoured division the corps will have limited power of manoeuvre. The Germans never used one armoured division by itself. Their Panzer Korps usually consisted of two armoured divisions and one light motorised infantry division. Even so, with the present day armoured divisions organised to contain equivalent proportions of armour and infantry, our Striking Force of one Corps will have a higher proportion of infantry in the ratio of five infantry brigades to two armoured brigades.

If the five infantry brigades cannot all be made lorry-borne, the answer is to reduce one of the armoured divisions to an independent armoured brigade. From the point of view of speed and manoeuvre, such a reduction is desirable as it does not materially affect the balance of the Striking Force. The corps will still have a ratio of four infantry brigades to two armoured brigades. Whenever the tactical situation demands, the independent armoured brigade can function as a normal armoured division by drawing upon the motorised infantry division for its infantry component. Under the prevailing conditions in India, this point is of special interest, because, what is lacking in our armoured division is not additional infantry but mobility for the infantry it already has, particularly the motor battalion which does require armoured personnel carriers. The main infantry element in the Striking Force, however, need only be lorry-borne. Under Indian conditions, an armoured division will not operate very far from a definite axis which will be invariably along one of the few main routes. It follows, therefore, that the infantry brigade will not be compelled to move across country to any appreciable extent, but would be confined to the main road axis followed by the armoured division.

Having discussed the broad aspects of its composition, a few other

features of the Striking Force need special emphasis. These are the organisation of its headquarters, its mobility and its hitting power.

Force Headquarters

The command of a force of this nature requires a high degree of ability both in its leaders and in its staff at all levels. It demands daring and mobile minded leadership for command and an efficient staff for keeping the wheels of this mobile force well oiled. As these two requirements cannot be produced on the spur of the moment, there is need during peacetime for the establishment of a properly constituted headquarters which can train itself and its subordinate headquarters at all levels in dealing efficiently and speedily with the problems of a war of movement. Such a headquarters would be in a better position to develop the technique of operations peculiar to the Force as well as to find satisfactory answers to the difficult problems of logistics. The necessity for the training of such headquarters was stressed during the war years by General Martel. In the North African Theatre, during the last war, the absence of mobile minded leadership and well trained headquarters both at army and corps levels was largely responsible for the initial disasters of the Allies and the slow tempo of their advances later on.

Mobility and Hitting Power

These two characteristics are considered together because they are indispensable and complementary in a war of manoeuvre. As armour and artillery are the chief slugging agents of the Striking Force, their requirements are discussed separately.

Armour

Captain Liddel-Hart has compared the British armoured division to a long sling with a small pebble at its head. With the post-war reconstitution of the armoured and lorried brigades on a three unit basis and a further reduction of the troop from four to three tanks, the pebble has become very small indeed. The main punching power of the armoured division is in its tanks. The infantry and artillery elements in the division, although indispensable, are there for enabling armour to carry out its tasks. The performance of these tasks depends more on the number and quality of tanks than on anything else. One way of increasing the number of tanks is for the armoured brigade to have four units as before. In like manner the tank troops should have the full complement of four tanks. There was never any justification, barring perhaps a temporary economic

expediency, for the three tank troop, which offends the basic principles of armoured fire and movement.

The procurement of the right type of tank for the proposed Striking Force is a big problem for a country like India. In this paper, however, the requirements of such a tank to suit Indian conditions can only be indicated. The tasks envisaged for the Force demand a tank which is hard hitting and yet capable of moving with speed. Heavy and cumbersome tanks are incapable of fighting a battle of manoeuvre. There is a strong tendency for these heavy monsters to sit on their haunches and fit into a static defensive scheme of things. In the race between weight of armour and the penetrativeness of the anti-tank projectile, the present-day tank is gathering too much dead weight around it, and in the process losing the battle. In its pre-occupation to defend itself against the anti-tank gun, the tank is losing its offensive characteristics of speed and mobility. Both for survival and for fulfilling its mission, the tank needs emphasis on its armament and speed rather than its armour.

Other factors which affect the selection of the right type of tank are, the state of roads and bridges in this part of the world, the problem of spares and maintenance, and cost. The paucity of road communications and the low classification of bridges generally, indicate that the weight of our tank should be between twenty-five and thirty-five tons. A minimum weight of twenty-five tons appears to be necessary from the point of view of mounting a powerful gun, the comfort of the crew and stowage space for ammunition. The main armament should be a high velocity gun capable of disabling a heavy tank at longer ranges of over 1500 yards. Such a tank would have a bigger radius of action and move faster than a heavy tank weighing nearly fifty tons. It would cost much less both in terms of production as well as running, which affects petrol consumption and road maintenance. In a war of movement, with its powerful gun, such a tank can be depended upon to defeat the heavy tank.

I have criticised elsewhere the concept of the 'universal tank' designed both for infantry support role and for the mobile role, as an attempt to combine mutually contradictory requirements. Nevertheless, under Indian conditions only one type of tank designed primarily for mobile warfare is desirable, until such time as we are able to produce sufficient numbers of tanks indigenously. This is the tank required for our Striking Force, and all other considerations like infantry support and anti-tank defence are of secondary importance. In this context it is interesting to

recall General Martel's observation, although he made it under different circumstances: "When the development of more powerful anti-tank guns renders even our latest designs of infantry tank useless, we shall be limited in the help we can give the infantry to the use of cruiser tanks alone, following them up or assisting them in some mobile role." On the few occasions when tanks are made available for infantry support it would be profitable to bear in mind the significance of these words.

Besides the armoured units of the Striking Force, it is desirable to equip all the other armoured units in the army with the cruiser type of tank described above. Amongst the numerous advantages of such a course, the most important one is that it provides an alternative source of completely trained and equipped armoured units for the Striking Force apart from its own replacement quota. The other advantages are, standardisation of equipment throughout the Army, simplification of the problem of spares and maintenance, and the saving of time and effort in training. If the self-propelled artillery units have their armament mounted on the same type of tanks with the necessary modifications, it will be an additional advantage. Until such time as we can produce enough tanks indigenously, standardisation of equipment not only solves the difficult problem of spares but also reduces the overall cost of purchase and maintenance.

Artillery

In view of the tasks of the Striking Force and its suggested organisation, the artillery element needs to be stepped up. The inclusion of a fourth field battery in each of the two self-propelled field regiments of the armoured divisional artillery is recommended. This additional fire power, while providing the fourth armoured regiment with its own affiliated battery for close support, would not appreciably increase the administrative tail of the division as would the addition of a third field regiment. The motorised infantry division would continue to have its normal complement of divisional artillery.

The necessity for fire support by medium guns for armour has long been appreciated but their inclusion in the organisation of the armoured division would make the division cumbersome and impose additional administrative responsibilities. These disadvantages could be avoided and yet the tremendous weight of fire of two medium regiments for the armoured divisions could be made available by holding them under corps artillery and allotting them as required by operational needs.

Air

Air support for a force of this nature would greatly increase the effectiveness of its operations, particularly if airborne troops can operate in conjunction with it, in what is sometimes euphemistically referred to as "vertical envelopment." With our present resources this may sound very ambitious but direct support in the tactical battles and air supply are indispensable. Air supply is particularly important in view of the fact that the Striking Force will not be able to spare troops to guard open zones of communications in its rear until a link up with the slower moving forces is effected. Without adequate air support the Striking Force will neither be able to achieve the necessary depth in its operations nor the degree of speed that is vital for success.

Engineers and Services

The contribution of the Engineers and the Services to maintain the mobility and speed of the Striking Force is not discussed here for want of space. Their importance is such that they need to be considered in detail separately. Their requirements should be worked out on the basis of making the Force self-sufficient while operating at considerable distances away from its base installations.

Conclusion

If "eternal vigilance is the price of liberty," then the contribution of the armed forces towards exercising this vigilance is constant readiness to guard our national security, which is implied in the "Role of the Army" as laid down by the Government. As far as the Army is concerned, this readiness implies the selection and development of the technique of war most suited to Indian conditions, and the equipment and the training of the Army in such a technique. An appreciation of the various factors involved indicates that the organisation and training of a Striking Force, as described above, is the best means of carrying out the role.

THE TECHNICAL STAFF OFFICER AND HIS CAREER

BRIGADIER L.S. ANAND

THE 'Technical Staff Officer', a modern breed of Service Officer, came into existence under that name after World War II, although he must have existed earlier in some form or the other. The requirement for such a type in large numbers was greatly felt during the second half of the War. The term 'Technical Staff Officer' has been derived from the British terminology, and has come to mean the counterpart of the General Staff Officer in technical appointments, although the parallelism is general, rather than specific.

In January 1944 the Army Council in U.K., in consultation with the Ministry of Supply, appointed a high-powered Committee, known as the 'Guy Committee', with the following terms of reference:—

"To examine the requirements of the Army for Officers with scientific and engineering knowledge and who are required for research and design in military or civil establishments ; and to make recommendations with regard to their training and the planning and control of their careers."

This Committee, after extensive study and investigation, concluded, amongst other things, that:—

(*a*) All Officers of all arms and corps should receive, during their early Army career, sufficient technical and scientific education to give them an understanding of modern weapons and equipment and their use. This preparation would permit Officers, at a later date, to be selected for the advanced instruction necessary to fit them for the higher technical and staff appointments.

(*b*) All Officers of certain arms, such as Engineers, Signals, Ordnance, and E.M.E., should receive, in addition to the education under (a) above, a thorough professional training in those scientific and technical subjects applicable to their corps.

(*c*) A relatively small but increasing number of Officers drawn from all arms require a high standard of advanced technical and scientific education to enable them to influence the use and development of war material, and ultimately to hold the higher appointments, which determine military policy in relation to weapons and organisation.

It was this third recommendation which led, from October 1946, to the institution of Technical Staff Officers' Courses of two years' duration at the Royal Military College of Science in U.K.

It would not be out of place to mention here that before and during the war, Army Officers were trained at the Military College of Science, and eventually qualified as 'pac' (passed advanced class). These Officers went in for too much specialisation in rather limited fields, and thus became a race apart, with the result that their careers inevitably suffered, and what was worse, the Army suffered by having little contact with these Technical Officers and vice versa. To overcome this handicap, at the end of 1945, a Committee under the then Military Secretary in U.K. was set up, who recommended that:—

"The Technical Staff Officer's career and opportunities for promotion to the highest appointments should be the same as for any Army Officer, and he should be considered in his turn for selection to command, and, in fact, be given command of a regiment, battalion, etc.; the responsibility for ensuring this will rest mainly with selection boards, but to assist in achieving this objective, a special branch should be set up under the Military Secretary, corresponding to that dealing with 'psc' Officers."

The developments in India are detailed in a later paragraph.

Specification for a T.S.O.

A Good Staff Officer

A T.S.O. must basically possess the attributes of a good Staff Officer. According to the conventional Service usage, these include, amongst other things, ability to exercise discretion and judgement, logical thinking, clear and concise expression, and elasticity of thought. They also include ability for preparing a precis or resume of a case or a report presentable for discussion at a conference. Although these attributes appear to be commonplace, they, in fact, are the back-bone of any good staff officer, technical or not so technical.

Position in Fighting Set-up

A T.S.O. occupies a position about midway between the front-line soldier, who is the user of equipment, and the scientist and engineer, who are the suppliers of the same. He makes an effort to understand the scientific and engineering problems involved in the design, development and production of equipment. He advises the User on such points, and explains to the General Staff the reasons why they cannot expect to reach the moon in five minutes. On the other hand, he learns to size up a new equipment in the light of his own user knowledge, and can advise the scientist and technician on its practical possibilities and limitations.

Confidence of Both Sides

A T.S.O. is looked upon as a technical expert in the company of Service personnel, and as a user expert among the civilians. To be able to perform his duties efficiently, he has to gain the confidence of both these types, who generally have different training, temperament and outlook in life. To gain the confidence of the scientists, he must obviously be in a position to speak their language, be aware of their conventions, be able to fit into an academic atmosphere and be capable of shedding his rank consciousness when necessary.

Degree of Specialisation

As his job is likely to bring him in contact with experts of widely different branches of science and technology, he has got to be a 'Jack' of most of these trades and be able to talk 'sense', while discussing a variety of them, often without previous notice. Here we come to a very debatable subject, of the degree of specialisation desirable in a T.S.O. Specialisation denotes 'knowing more and more about less and less' and, mathematically speaking, this would mean, in the extreme limit, knowing everything about nothing. On the other hand a T.S.O. has got to know something about lots of things, and carrying this to the absurd extreme, it would amount to knowing nothing about everything. This involves us in an argument on those two mathematical extremes, *i.e.*, infinity and zero, which are not always bound by the common laws of mathematics. Considering the user knowledge aspect, a T.S.O. is expected to be (or sometimes pretends to be) a user expert of everything connected with the Service. It is essential, therefore, for a T.S.O. to have a wide user knowledge, not limited only to 'Tewt's and paper battles, but extending to actual field experience under active service conditions. Only then would he be in a position to appreciate the line of thought of Bhupat Singh, Tommy Atkins or G.I.

Joe—those 'buck-privates' who form the most important part of any fighting Service. It is clear, therefore, that a T.S.O. has got to maintain a happy balance between the mysterious professors and the trigger-happy troops.

Spheres of Employment for T.S.Os

The following spheres of employment are open to the T.S.Os :—

Inspection of Warlike Stores

The responsibility for the acceptance or rejection of newly manufactured warlike stores must remain with the Service Officer, whether the manufacturers are an Ordnance Factory or a commercial concern. A T.S.O. knows from the user aspect what exactly is expected regarding the finish of a certain equipment and how urgently it is required by the troops. He should also know, because of his previous user experience, the usual weak points of a particular equipment and so be able to pay particular attention to them while accepting the new product.

Occasions often arise when the Inspector has to make a credit and debit balance-sheet in respect of a doubtful product. The choice may lie between throwing away an almost acceptable store and keeping the troops in the front rank supplied with equipment (perhaps slightly below normal standard). If the Inspector is not fully qualified, he may accept a weapon which would either not fire at all in the face of an enemy or which may even be a source of danger to own troops. He would then be guilty of misconduct of a very higher order and would perhaps be responsible for the loss of a battle or even a war. On the other hand, being not sure of his ground, he may be over-cautious and may deny the equipment-hungry troops stores which would have been perfectly serviceable, even though not 100% up to specification. A T.S.O. is obviously best suited to perform this inspection role.

Design and Development Role

Another important field of employment for a T.S.O. is in the Service Design and Development Departments. The General Staff would dictate a policy statement for a new equipment. This demand goes to an expert designer or specialist, and may require original research or investigation into an unknown field. The General Staff are not always aware of the manufacturing capacity, or physical possibility of the processes and techniques involved. It is, therefore, only right that these policy statements are conveyed to the specialist by a T.S.O. who is able to discuss with the expert in his own language. Moreover, the T.S.O. would also ensure,

before conveying such demands, that the Services have not asked for the obviously impossible.

Trial and Experimental Role

Technical and user trials play an important part in the chain of production of new equipments. When the design is complete and a prototype is ready, it must undergo extensive technical trials, and the T.S.O. is best suited for conducting them. After the results of these trials have been carefully analysed and necessary modifications carried out by the designer the equipment has to undergo user trials. Although such user trials would be controlled by the General Staff, the officer in immediate charge of such trials should obviously be a T.S.O.

Proofing Establishments

When a mass production order is placed, a weapon or a batch of ammunition, in addition to undergoing the normal inspection procedure, has to be 'proofed'. The T.S.O. is best suited for conducting such proofing of equipment.

Technical Military Intelligence and Purchasing Missions Abroad

The provision of an efficient Intelligence Service needs no emphasis and the employment of T.S.Os in Technical Intelligence, both in peace and war, would certainly be in the fitness of things.

Until such time as we reach a stage of self-sufficiency, an important source of provision of Armament would be by procurement from abroad. It is apparent that we must employ qualified T.S.Os in such purchasing and procurement missions. Their employment in this role has hitherto been insignificant. This might be because of an insufficient number of T.S.Os so far available. It is evident, however, that the Offices of our Military Attaches and Missions, particularly in the industrially more advanced countries, should be manned by a generous proportion of T.S.Os.

Technical Staff Field Force

T.S.Os have often been regarded as "chairborne troops." It must, however, be pointed out that, in the last War, the employment of such Officers to advise Field Commanders of higher Formations proved to be most advantageous. The Weapons Technical Staff Field Forces (W.T.S.F.F.) and A.F.V. Technical Staff were operating in all major theatres of that war, and did most useful work. It is said that in the earlier stages of the war the Force Commanders were very sceptical about their usefulness and often suspected their intentions. But the Technical Staff

succeeded in gaining their confidence, and then were much in demand by all higher Commanders.

Regimental Centres and Schools of Instruction

In some quarters, a fallacy appears to prevail that a T.S.O. can be employed only in spheres other than regimental, some of which have been indicated above. This is far from true. In fact, the T.S.Os would be equally useful in certain regimental appointments in the Regimental Centres and Schools of Instruction of various Arms and Services. The training received by a T.S.O. of rational thinking on technical lines, and the wide circle of his interests would also make him an asset in the planning section of higher formation headquarters, particularly the Directorate of Weapons & Equipment in the G.S. Branch.

Reserve and Return to Regimental Duty

It is obvious that if a T.S.O. stays too long in an E.R.E. appointment, a stage may come when he will have forgotten all about the Service. He may then become a civilian in uniform and may lose a great deal of his usefulness. The exact tour of duty for which the T.S.O. should be employed in a purely technical sphere has been often debated. However, it is essential that a T.S.O. undergoes sandwich periods of regimental and E.R.E. appointments, so that he can maintain his dual interests. To be able to cater for this, we must allow adequate reserve for the turn-over.

Developments in India

When the first Technical Staff Course in the U.K. was being planned in 1946, this country was still under British rule. India was offered six vacancies to the first T.S.Os Course commencing October 1946. Of the six officers that qualified from this course, one opted for Pakistan at the conclusion of the course in September 1948. Of the remaining five that opted for India, one was boarded out on medical grounds and another retired from service. That leaves three officers on the active list from that lot. Before the commencement of the second T.S.Os Course in U.K. in October 1947, India had become independent and admission of Indian Officers to the Royal Military College of Science was banned, until two more vacancies were allotted in the Ninth Course which opened in October 1954.

In the meanwhile, we just could not afford to sit back and hope for the best. In 1949, with the barest of facilities, an Ammunition and a Weapons Course of nine months' duration were run simultaneously under

the aegis of the Directorate of Technical Development at Kirkee and Jubbulpore. Subsequently, two long Technical Staff Officers Courses (each of two years' duration) were run under the improvised arrangements at Kirkee. These departmental courses were run on practically 'no cost' basis in the face of the then prevailing financial stringency. The instructional staff had to undertake this heavy extra responsibility 'in addition to their normal duties'. In the face of apparently insurmountable difficulties, these two courses were run with dogged determination and enthusiasm.

Institute of Armament Studies

In the meanwhile, a proposal was put up to the Government of India in 1950 to set up the Institute of Armament Studies (an establishment under the Ministry of Defence), one of whose main functions would be to undertake technical staff training for the Army in the first instance and for the other services as and when facilities become available. After two years of deliberation, formal governmental sanction was given and the Institute of Armament Studies nominally opened 'shop' on the 1st of May 1952. But in fact at the time there were literally no men, materials or premises to run the Institute. With what facilities could be mustered during a period of about a year, the third Technical Staff Officers Course began from 1st October 1953 (the first two having been run under the arrangements of the D.T.D.), and was due to finish by March 1955. The fourth T.S.Os Course commenced in October 1954 and arrangements have now been made for subsequent courses to come in October every year.

The graduates from these technical staff courses will be awarded the symbol 'ptsc' which is similar to the 'psc' awarded by the Defence Services Staff College with the addition of a 't' which takes care of the technological aspect of the staff training given to them. They enjoy the same qualification pay and are recognised to be generally on a par with the graduates of the Staff College.

POTENTIAL OPPORTUNITIES FOR A T.S.O.

It has been established earlier that the T.S.O. forms an extremely important link in the chain of production of warlike stores. There are some very important appointments ready to be filled by such officers. Besides more and higher appointments are bound to come up as the mechanization of the Defence Services progresses. At this stage it is indeed difficult to make even a rough guess of the ultimate requirement of this class of officers.

As a matter of interest, let us briefly examine some of the appointments in U.K. reserved for Technical Staff Officers in the conventional armaments alone. The major employer there is the Ministry of Supply (the Ministry responsible for research, design, development, production and inspection of Army and Air armaments). The seniormost T.S.O. in that Ministry is the Controller of Supplies (Munitions) (Lt-Gen), who is one of the four Controllers in the Ministry, with an Assistant Controller of Supplies (Munitions) (Maj-Gen). Some of the departments under the Controller are:—

Directorate General of Artillery (not to be confused with Directorate of Royal Artillery in the War Office)	(Includes Maj-Gen, Brigs, Lt Cols & below)
Chief Engineer Armament Design	(Although himself a civilian, employs Brig, Cols, Lt Cols & below)
Chief Inspectorate of Armament	(Brig, Cols., Lt Cols & below)
Chief Superintendent of Armament Research	(Himself and majority of the staff are scientists, but employs Col, Lt Cols & below)
Chief Superintendent of Ranges	(Brig, Lt Cols & below)
Directorate General of Production	(Col, Lt Cols & below)
Weapons Tech. Staff Field Force BAOR	(Col, Lt Cols & below)

In addition to the Ministry of Supply the War Office employs T.S.Os in the following establishments:—

Royal Military College of Science	(Maj-Gen, Cols and about a dozen other TSOs)
Scientific Adviser to the Army Council Director of Royal Artillery Director of Infantry School of Artillery	(TSOs 6)

The Ordnance Board in U.K. which is an inter-service organisation employ Maj-Gen, Cols and Lt Cols/Majs in the Army quota and a similar number from the Royal Air Force and Royal Navy.

The figures indicated above are not up to date or complete. The information will however help to give some idea of the role of the TSO in U.K.

Conclusion

Much of this article has dealt with the pattern of the Technical Staff as it has grown in the U.K. Undoubtedly we shall have to modify that pattern to suit our own requirements. This does not alter the fact that there is an urgent requirement of efficient and experienced Technical Staff if we are to make progress in the design and production of arms and equipment for our Defence Services.

The Technical Staff Officer has come to stay. His functions are vital to the growth of our equipment and hence to our National security. Equally vital is it to plan his career so that officers of the right calibre and in adequate numbers will be attracted to it.

SOME IDEAS ON ARMAMENT DEPOTS

Colonel H.C. Vijh

ARMAMENTS for the army, navy and air force are manufactured in ordnance factories, but are stored in armament depots situated away from the factories. Each service has a number of armament depots, each depot holding a certain quantity of armaments and located strategically so that when the service is called upon to go into an operation it finds the necessary armaments in a handy position.

The design and construction of armament depots is the military engineers' responsibility in peace and war. But during a major war, when a country's total resources are required to be pooled and all engineers, civil and military, have to pull their weight in the country's war effort, civil engineers may be called upon to assist in the design and construction of armament depots. Even in peace time it is not unusual to call upon the public works department or Port Trust engineers to build for the armed forces. The subject should therefore be of interest both to the military and the civil engineers, though of course the military engineer must know it as an essential part of his professional knowledge.

Deciding Location of a Depot

Strategic consideration is obviously the main factor governing the location of an armament depot. It is a part fitting into the grand strategy of the country as a whole. Into this consideration the military engineer enters only indirectly as far as his contribution to the preparation of the country's strategic plan goes.

Defence of an armament depot against possible enemy attack by land, sea or air is a particularly important factor which affects the choice of its location. This concerns all the three Services, and not the one Service only to whom the armament depot belongs. The military engineer, who would in due course be called upon to create land obstacles and strategic communications, must obviously have a say in the siting of the Depot from this consideration. Even if he is not specially consulted about

this, he should try and force his view-point on the deciding authority in order to make his own task easier in the long run.

An armament depot must be located at such a place as will make transportation of materials from and to the depot by rail and/or road and/or water as convenient as possible. As the responsibility for transportation of military goods often devolves on the engineer, and he may even have to build new communications to meet the requirements of the case, his correct advice in choosing the location of the Depot is of great consequence.

The last, but not least, factor governing the location of an armament depot is the nature of the ground, soil and climate at the proposed location in so far as it affects the stability and economy of the structural design of the magazines and appurtenant buildings. Here the engineer is exclusively on his own premises and he must on no account allow himself to be forced into accepting an unnecessarily difficult location from the structural stand-point. He must painstakingly ascertain the climatic, topographic and soil data, and, if he has genuine reasons to reject a particular site, it is for him to offer suitable alternative sites meeting the Services' other requirements as far as possible.

It almost goes without saying that every location presents a greater or smaller clash between the various factors affecting its choice. For instance, a site which is good from strategic and defensive considerations may present transportation and structural difficulties. The best combination of advantages would of course decide the issue in all such cases, and the engineering considerations may often have to be subdued considerably by the other requirements.

Underground Versus Overground Storage

Underground Storage

The building of underground armament depots, by providing chambers cut into hill sides, was in favour until the beginning of the second world war. These were normally of two types. In one of these an underground natural or tunnelled area was used for the purpose, and the whole stock of armaments was put under one roof or the area was subdivided by natural or artificial barriers into two or more sub-areas. In the other type a more or less parallel series of magazines were constructed in the hill side, the magazines being separated sufficiently to exclude the

risk of explosion being propagated from one to the other. Some of these underground repositories in the militarily forward countries had head covers varying from 40 feet to 100 feet.

The pre-war preference for underground armament depots appears to have been psychological only, presumably because it produced the primeval feeling of safety behind massive walls and roofs.

The main apparent advantage of underground storage was the protection offered against aerial bombing attacks. This is now doubtful. Bombs developed during the second world war could penetrate up to 60 feet of good earth and cause spalling up to another 60 feet below the point of burst. These bombs could also penetrate up to 10 feet of reinforced cement concrete. The subsequent aim of technically advanced nations has been to develop bombs which would penetrate up to 25 feet of reinforced cement concrete, and it is reported to have been achieved in several cases.

Another advantage claimed for underground depots was lower storage temperature in tropical climate. But with the improvement in the ammunition design, *e.g.*, progressive elimination of fulminate in cap and detonating compositions and introduction of more suitable propellants, the balance from the point of view of protection of armaments swings to the side of protection against high humidity which is prevalent in underground storage space unless elaborate air-conditioning, which can be exorbitantly expensive in initial and recurring cost, is resorted to.

The positive disadvantages of building an armament depot into a hill side or underground are many. It makes expansion in emergency rather difficult, slow and expensive. The risk from sabotage and accidents is great inasmuch as an explosion in any part is likely to affect the whole range. Other difficulties are the limitation on the types of explosive that can be stored underground, earth falls which make maintenance of cleanliness impossible, approach bottle-necks, uncomfortable conditions of work, and delay in removing individual items from the site for examination or testing.

Comparative Cost

As regards comparative cost of underground and overground storage, the United States' publication "Military Review" of June 1948, while discussing German storage installations, worked out that the cost of an underground storage building might vary from 3 to 10 times that of an

overground building, depending on the nature of soil, depth of head cover, etc. This heavier initial outlay in case of underground storage is exclusive of air-conditioning, which is necessary to counteract moisture effects and involves continuous expense.

Effect of Atomic Attack

No military discussion can be complete these days without a reference to the fell atom bomb. From present evidence, atomic attack of service explosive storage sites is unlikely, owing to the cost of the bomb, its scarcity and the existence of more attractive targets. Atom bombs of the penetration type are not likely to be available in the foreseeable future ; and radiation from the atom bomb will not affect explosives, though the area will remain contaminated for a considerable period. In any case, to expect to design, with present engineering knowledge, a storage building which would be proof against the effect of an atom bomb dropped nearby would be foolhardiness, knowing that 12 inch brick walls are demolished at a radius of one mile from the point of atomic explosion. Thus, in the planning of armament depots at present one can safely ignore protection against atomic attack, especially when the use of atomic energy in future warfare is a highly debated international question.

Overground Storage

The underground storage having no marked advantage as seen above, not even against atomic attack, there is no justification in squandering money on such storage for merely satisfying conservative opinion or a primeval feeling of greater safety behind a heavy cover, when overground storage is so much cheaper. Also, the positive disadvantages of underground storage are mostly eliminated in overground storage.

Besides, a highly desirable point is to arrange storage of explosives in such a way that, whilst reasonable protection is provided against bomb, the roof of the magazine should lift in case of an internal explosion, instead of the blast or flame being restrained and thereby forced to sweep through the entire series of magazines. This feature can be provided only in magazines built above ground.

Suitable Design of an Overground Magazine

Type of Structure

As argued before, the design and size of modern heavy missiles precludes the advisability of attempting to design buildings which would resist the direct impact of such missiles. This reduces the purpose of a storage

building to the maintenance of the ammunition and explosive in a serviceable condition. The lightest weather-proof structure would fulfil this purpose.

A heavily constructed building is liable, in the event of falling down under the blast effect of a heavy missile landing within an effective distance from it, to drop weighty debris and tamp its contents sufficiently to convert a cordite fire into a violent explosion. Further, in case of an accidental internal explosion in a magazine, a heavy roof will not open up and, by thus disallowing the blast or flame to escape, will constrain it to cause a more devastating effect. Thus, a heavy structure, is not only unnecessary but also undesirable.

If, however, we can have a structure which is light enough to be able to open up under an internal explosion and yet is strong enough to be able to resist the entry of a light incendiary bomb—4 lb. incendiaries are common—we will have arrived at an ideal solution. A "bunker" type of building with a "ribbed" roof meets this ideal. A "ribbed" roof consists of a series of T-beams, that is, a reinforced concrete structure consisting of a thin shell with ribs at intervals. Such a roof offers a greater resistance to an external hit or blast, because of the T-beam effect ; but, to the pressure of an internal blast, it offers little resistance—the T-beams being on the wrong side and the shell offering the only resistance in this case—and readily opens up. The overground "bunker" type magazine with a ribbed roof was the German favourite during the world war, and the Americans extolled it after the war in the "Military Review".

Size of a Magazine

The size of a magazine depends on the quantity of explosive or ammunition acceptable as a single risk. This is a matter depending on the policy of a Service. The Germans went in for rather small-size magazines during the world war, presumably for greater dispersal of stock.

The size of a single magazine also depends on the total area available for an armament depot, because certain 'safety distances' must be provided between the various magazines themselves and between them and other subsidiary buildings, as we shall see later.

A sound designing figure is to allow 40 cubic feet of space for 1 ton of magazine stores. The economic height to which cases of these stores may be heaped up is 10 feet ; more than this height is not desirable. Thus about 4 square feet of floor area is required for each ton of armaments. To

have working space, it is desirable to split stores in a magazine into four heaps, leaving an all-round passage next to the walls and also passages running centrally between pairs of opposite walls. The provision of working space will roughly double the floor area required for each ton of armaments. Thus, for storing 1000 tons in a magazine, it will have to have a floor area of about 8000 square feet, which is a reasonable unit for adoption. The height of the magazine would be about 18 feet at the apex from the floor, in order to leave sufficient space above for air circulation, ventilation, and space for working and gantry operation.

Openings in a Magazine

Both for safety and security, more than one opening, *i.e.*, the entrance and exit door, should be avoided. One or two small piped openings should be provided for ventilation in the roof, but they must be made completely rain-proof by adequate cowls fixed on top of the pipes.

Floor

The atomic experts recommend that the floor of an overground magazine should be somewhat below the ground level. The floor should be completely damp proof ; a 4 inch thick concrete floor made of a mix rich in cement, with a 4 inch hard core below sealed on top with a layer of bitumastic, should easily fulfil this requirement.

Foundations

The safe bearing pressure of the soil should be carefully ascertained and the foundations designed accordingly. The foundations to the walls must be thoroughly sealed with a reliable damp-proof material to obviate any possibility of moisture from below rising to the wall.

Walls and Roof

The concrete walls and roof of the bunker must be sealed externally with a damp-proof material to prevent rain, dew or moisture affecting them in any way.

Lighting

All wiring should be completely covered with conduits, which should be properly earthed, and all lamps should be of the guaranteed flash-proof type.

Lightning Conductors

All magazines having an explosive quantity of 200 lbs. or over should be provided with lightning protection.

Means of Mechanical Handling

Each magazine should be provided with a gantry and travelling hand-operated crane of about 1½ tons capacity.

Camouflage

The roofs of magazines should be lightly and roughly covered with earth, which may even be turfed, to avoid recognition from air.

Subsidiary Structures Necessary in an Armament Depot

In addition to a number of magazines for storing the armaments for which an armament depot is designed, a modern depot requires a large number of subsidiary structures to fulfil various technical and administrative requirements. While these subsidiaries must obviously vary somewhat with each type of depot and the needs of the Service for which it is meant, the following typical list for a 5000 tons armament depot will serve as a broad guide to the normal requirements:—

(*a*) Laboratory blocks, consisting of about 24 rooms each of size, say, 20 ft × 20 ft, with a few rooms air-conditioned for special purposes.

(*b*) Non-explosive stores block, consisting of 4 to 6 large rooms, say, 50 ft × 30 ft each.

(*c*) Non-explosive dangerous stores block, with 4 to 6 large rooms, say, 50 ft × 30 ft each.

(*d*) Isolation magazine block, having 4 to 6 chambers, each of about 15 ft × 10 ft size. These must be of reinforced cement concrete with traverses.

(*e*) Technical building of a large size, say, 100 ft × 25 ft.

(*f*) Gun shop, about 3,000 sq ft in area.

(*g*) M.T. Shop, about 3,000 sq ft in area.

(*h*) Depth charge pistol room, about 65 ft × 20 ft in size.

(*i*) Gun mounting depot, comprising about 30,000 sq ft of shed, about 20,000 sq ft of workshop area, gun grounds, etc.

(*j*) Garages for MT and POL stores.

(*k*) Empty package store, say, 100 ft x 50 ft.

(*l*) Paint store, about 1,000 sq ft.

(*m*) Administrative buildings, comprising offices for officers and

clerks, record rooms, pay block, medical inspection room, accommodation for security force, etc.

(*n*) Residential accommodation for officers, JCOs, clerks, key personnel, firemen, etc. inside the premises of the armament depot.

(*o*) Accommodation for residential skilled and unskilled employees and labour near the depot.

(*p*) Miscellaneous provisions, like perimeter fences, rail facilities, decauville tracks and rolling stock, receipt and issue platforms, approach and internal roads, fire fighting installations, water supply, electrification, furniture, sanitation, etc.

Safety Distances and Other Safety Precautions

Inside Safety Distances (for above-ground buildings)

'Inside Safety Distance' means the minimum distance to be kept between a building containing explosive and other buildings containing explosive, which will prevent the direct propagation of explosion from the building to explosives in the other buildings by missile, flame or blast.

'Inside Safety Distances' depend on whether the magazines are traversed or untraversed (see subsequent paras). They also depend on the net quantity of explosives in the magazines between which the distance is to be decided, the 'safety distance categories' of these explosives and their relative 'charge/weight ratio'——the meanings of these terms are explained below.

Explosives are classified into several categories for deciding the 'inside safety distance' at which each type requires to be placed from other stacks of explosives in order to prevent direct propagation from it to other stacks by missile, flame or blast. Some of the different categories are (*a*) explosives which have a fire or a slight explosion risk or both but the effect of which will be local, (*b*) explosives which have a mass fire risk or a moderate explosion risk but not the risk of mass explosion, (*c*) explosives which have a mass explosion risk with serious missile effect, (*d*) explosives which have a mass explosion risk and minor missile effect, (*e*) weapons containing toxic materials with or without explosives which have a toxic risk with or without a slight explosion risk, etc, etc. 'Inside safety distances' for various categories of explosives, to achieve the standards of safety set, are then worked out, from extensive trials on explosions and storage conditions, and tabulated

for use. Such data are of course a secret of each nation just as are the types of armaments produced by it.

The risk of propagation of explosion from one magazine to another depends on the 'charge/weight ratio' of the explosive in both the magazines ; for example, if a stack of HE aircraft bombs having a charge/weight ratio of 20 per cent is adjacent to a stack of HE aircraft bombs having a charge/weight ratio of 80 per cent, the risk of propagation from the 20 per cent stack is greater than that from the 80 per cent stack because the latter is more vulnerable to effect from the former.

An approximate idea of 'Inside Safety Distances' may be given by quoting a few instances. The safety distance between two magazines containing 500 lbs of explosives each should be about 30 ft to 40 ft depending on the type of explosive ; that between two magazines containing 1000 lbs of explosives each should again be between 30 ft to 40 ft depending on the type of explosive. The safety distance between pairs of magazines containing 10,000, 100,000 and 1,000,000 lbs of explosive each should be between 44 ft to 82 ft, 90 ft to 175 ft and 90 ft to 480 ft respectively, depending on the type of explosive.

Outside Safety Distance

'Outside Safety Distance' refers to the clearance to be observed between the Enclosed Explosive Area, containing all the explosive storehouses and appurtenant buildings where explosive is likely to be used, and other structures outside the Enclosed Explosive Area, *e.g.*, buildings, water-supply, etc, meant for use of general public, who may or may not be employees of the Armament Depot. It is the distance at which the ignition or the explosion of the complete contents of the Enclosed Explosive Area will not cause serious structural damage by flame or blast to the normal type of civic dwelling houses and structures ; it however does not exclude the minor risks of glass-panes getting broken, roof-slates getting displaced or ceilings of buildings falling down.

'Outside Safety Distance' obviously depends on various factors, *e.g.*, types of explosives, total weight of explosives, disposition of the various magazines and nature and weight of their contents, etc. The Outside Safety Distance on each side of the Enclosed Explosive Area is worked out from tabulated experimental data and as a mathematical deduction from 'Inside Safety Distances.'

Traverses

Earth traverses are invaluable in preventing missiles escaping from explosion in a building or entering into an adjacent building. They thus fulfil an important, though secondary, function of protecting explosives, of any category in a building from missile attack.

An 'effective traverse' should have its inner side close to the building. It should have a crest at least 3 feet wide, with the earth at its natural angle of repose on each side. Its height should not be less than 2 feet above the top level of the explosive in the building. Sometimes, to save space, the inner side of the traverse may be constructed vertical in brick or concrete, in such cases the crest of the traverse should be at least 5 feet wide. A bunker type building may have earth piled against its walls, with its walls acting as the inner side of the traverse. Any building having less protection than specified for an 'effective traverse' is considered as untraversed.

Blast Walls

These used to be provided in the olden days but are now considered of doubtful value. They exercise little influence on the spread of flames, blast or toxic vapours. They may also not prevent missiles escaping freely to attack adjacent explosive-houses, as missiles, being associated with detonation, may be produced by a shock wave at short range.

Storage of Petrol and Oil in the Vicinity of Explosives

The risk to underground storage of petrol near an explosive store is by earth shock only, whereas the risk to overground petrol storage is also by fire, blast or missile. Therefore, it is enough for underground petrol storage units to be sited beyond the Inside Safety Distance of the explosive storage. The overground units, however, must be sited beyond the Outside Safety Distance and, in addition, be provided with bunds around sufficient to contain the entire contents of the units in the event of the reservoirs breaking up.

Internal Transport of Armament Depot

For greater flexibility, trackless transport is preferable to narrow gauge railway for moving about explosive and non-explosive stores within an armament depot. Such transport, whether diesel or electric, must be fitted with spark and flame proof arrangements and other safety fittings. In the United Kingdom diesel locomotives are equipped to coal mines standard in this respect.

Conclusion

As the subject vitally affects the defence and security of any country, each government has normally a policy laid down in this respect, which ties down the engineer and restricts his scope for initiative. Still, the broad guiding principles governing the design and layout of armament depots given here should be applicable in most cases, because after all a government policy on any engineering subject cannot run counter to the basic principles of engineering.

SUBMARINES

COMMANDER V.A. KAMATH, I.N.

IT was announced recently that the United States Navy had started trials on an Atom-powered submarine, the first ever vessel to employ this revolutionary means of power generation. This is indeed a unique honour for a weapon, of which in a statement to the British Parliament in 1900, the Parliamentary Secretary had said,

"The Admiralty are not prepared to take any steps in regard to the submarine because this vessel is only the weapon of the weaker nation."

That this development of submarine propulsion should be presented to the world by a country none other than the United States of America is a clear indication, if this were needed, of the radical change in submarine thought among the leading maritime countries of the world. Yet, it was an American by name of Fulton, who as early as 1809 demonstrated the first practical submarine, and again it was an American submarine, designed by one Mr. Holland that was first used by the Royal Navy in 1901 to develop their own submarine design.

It is not intended in this article, to recount the early history of submarines, for that is of little interest to the average reader, neither is it intended to discuss the tactical and strategic potentialities of this weapon. The submarine has been making news headlines in both the two world wars, and even now in these so called days of peace, it continues to attract attention to itself by virtue of the existence of a state of cold war between nations. What most people would probably wish to know is something of the mechanics of a submarine ; what it is like inside a submarine ; how it is propelled, dived and surfaced ; how it is fought and in fact the answers to the many questions that invariably rise to one's mind when it is an underwater vessel that is being talked about.

Unlike the Aeroplane which has a commercial and civilian role, the submarine is a weapon of war, pure and simple, and so it will in all probability remain throughout its existence. It is difficult to visualise any call for human beings to hide under the surface of the sea, when above, the whole oceans, the land and the air are free for all to use within the limi-

tations of International Law. It is this, a very much restricted role given to the submarine, that makes it so to say a ' closed book ' for the layman. Let it not be thought that the average fighting sailor knows much more about it than a layman ! He may know the capabilities of a submarine, and may have been trained to employ it as a weapon in war, as well as to fight it when the need arises, but the average sailor knows little of what goes on inside the submarine unless he is a submariner himself.

Where possible it is usual for junior Naval officers to be sent to the nearest Submarine base, for a day or two at a time during the course of training, to learn what they can about these vessels. This as might be expected does not give the officers more than a superficial knowledge about the inside of a submarine. Such being the case, it is presumed that many would like answers to the several unanswered questions they have about submarines. It is hoped that some at least of the many answers will be found in the following paragraphs.

Structure and General Arrangements

The submarine proper is shaped somewhat like a cigar and is known as the pressure hull of the submarine. To this on the outside are " strapped " the Main Ballast tanks and a casing put on top, to provide the sea keeping qualities and enable the crew to walk on top of the submarine. Somewhere near the middle of this casing is built the Bridge casing, which provides a reasonably sheltered bridge from which to manoeuvre the submarine when she is proceeding on the surface. Sticking out upwards from the bridge are usually two periscope standards and the Radar and Radio aerials. In front of the bridge structure is a medium calibre gun and on the bridge structure itself there may be a number of smaller anti-aircraft guns, which are usually brought up from below and mounted when required.

The inside of a submarine is divided into Compartments by water-tight bulkheads in the same way as is done in a surface ship. To enter a submarine in harbour, the normal way would be by the Torpedo loading hatch in the forepart of the boat. This would lead us into the Torpedo Stowage Compartment. Here one will see the spare set of torpedoes stowed, ready to be loaded into the forward tubes when once those already in the tubes have been fired. The Torpedo tubes themselves are in the Torpedo Space forward of this Compartment and separated by a water-tight bulk-head.

Walking aft from the stowage compartment, through a water-tight bulkhead, we come to the living spaces for officers and ratings. We shall

not dwell on this, except to say that living accommodation in submarines is cramped, even by warship standards. Anyone who has walked round the mess decks of a warship can imagine what it is like in a submarine's mess decks.

The next water-tight compartment aft is the Control Room. This is really the heart of the submarine. There are levers for operating the valves which flood the ballast tanks to dive the submarine, and more levers which send high compressed air into the same ballast tanks to drive the water out and surface the submarine. There is also the steering wheel and operating levers for working the hydroplanes. The periscopes and radar masts are raised and lowered from this room. The Control Room also contains the chart table, attack instruments, and asdic operating control for working the underwater signalling and hearing device. In addition there would be the Master Gyro Compass, diving gauges etc. and in fact the whole room is a maze of wheels, pipes, electrical switchboards and machinery which is apt to make a newcomer wonder whether anybody could possibly understand this all! The fact is that with experience and familiarity, the tangle of machinery sorts itself out to the Submariner. At the after end of the Control room are usually located the Radar and W/T offices and sometimes also the Galley—all these being separated from the Control room by a dividing panel.

The next compartment is the Engine room where there are usually two large diesel engines. These engines require fresh air and as such in the older submarines could not be used when the submarine was submerged. In the latest boats, sufficient air for running the diesels can be provided by the snort mast, when the submarine is submerged to periscope depth, which is also the depth of the snort mast. If however the boat goes below periscope depth, the snort mast cannot be used and the submarine has to be run by means of the main (electric) motors. Oil fuel and lubricating oil for the diesel engines are kept in tanks along the bottom of the submarine distributed throughout the length of the vessel.

The next room houses the main motors which drive the submerged submarine and which get their electric power from batteries. These batteries which together weigh over 150 tons are stowed underneath the forward living compartments and the Control room. Overhead in the Motor Room is the hatch leading to the upper deck for use of the engine room staff in harbour, and also for passing engine parts in and out of the submarine. Going further aft, we come to the Stokers' living space,

which is similar to that of the Seamens' forward, and lastly the Steering compartment which houses the engine for working the rudder.

Returning to the Control room, we see two ladders, one leading up through the Conning Tower on to the Bridge through two hatches, and the other leading up to the gun, forward of the bridge. The Bridge itself as already stated is built up on top of the outside casing of the submarine, and contains a chart table, water-tight compass, engine room telegraphs and voice pipes to the Control room. Running from the bow, over the periscope standards, and down to the stern is a strong 'jumping wire' to protect the boat from enemy sweep wires and other hazards when dived.

How A Submarine Works

Two distinct operations are necessary to dive a submarine, but in practice they are done concurrently. Firstly the buoyancy must be destroyed and then the boat forced under the water by hydroplanes (there is one pair forward and one aft) while the propellers drive the boat forward.

The Buoyancy of a submarine is initially destroyed by flooding the Main Ballast tanks, and finer adjustments made by operating the Compensating and Auxiliary Ballast tanks provided inside the pressure hull, so that the boat can be trimmed. When 'in trim' the submarine can hover submerged with propellers stopped. Calculations are worked out before leaving harbour to adjust the trim for any changes in weight that may have taken place since the submarine was last at sea. Fuel and stores embarked ; changes in the number of men carried ; all these will affect the trim when the submarine dives, and to allow for these changes, water is pumped out of, or taken into, the internal Compensating tanks according to the calculations. Naturally, the trim as calculated may not always be exactly right due to changes in density of sea water and small inaccuracies in the weight used for calculations, but can be quickly corrected by further adjustments. It is easy to see that the weight of a submarine is changing all the time it is running, due to consumption of oil fuel, changes in the density of the sea water encountered etc., and as such the trim may have to be adjusted every few hours.

Returning to the surface requires positive buoyancy, and this is achieved by admitting high compressed air to the tops of the Main Ballast Tanks and blowing the water out. Compressed air which is the life blood of submarines, is kept in groups of bottles tucked away in bilges throughout

the length of the boat, the system maintaining a pressure of about four thousand pounds per square inch.

In practice only a small amount of compressed air is used up from the system in surfacing. As soon as the conning tower is out of the water, and it is safe to open the upper conning hatch, air pumps are started to blow the remaining water out of the Main Ballast Tanks and bring the submarine to full buoyancy. Once on the surface, high compressed air expended in surfacing is replenished, and also the batteries which may have lost much of their charge under-water, are recharged.

The Snort

The "Snort" which enables the submarine to run its diesels at periscope depth, is a pipe about 14 inches in diameter which when not in use is stowed horizontally on the deck of the submarine where it fills with water. The raising and lowering of the snort mast is carried out hydraulically. When raised for use, the water is drained down into the submarine through a valve. To prevent ingress of water into the submarine from the open end of the snort mast by lapping waves, an ingenious float valve system operates momentarily each time. When snorting, exhaust gases from the engine are lead out of the submarine just below the surface, through an exhaust pipe fixed to the after bridge standard. Once the water in the exhaust pipe is initially blown out, the exhaust pressure from the engines keeps the pipe free of water.

Periscopes

All submarines have two periscopes. One known as the Low Power Periscope is used in the final stages of an attack. For this reason it has a very small top, so that little 'feather' will be shown when close to the enemy. The other, the High Power Periscope or the Search Periscope is binocular and bi-focal, and includes range finding and sky searching arrangements. It has a diameter of over nine inches and tapers to about five inches at the top. Objects can be seen through it as far as ten miles on a clear day. The periscopes are raised and lowered by wire pulleys operated by hydraulic rams and where they pass through the pressure hull, special glands are provided, designed to withstand the high water pressures acting on them.

Wireless

One of the great limitations in submarine work is the inability to transmit wireless messages from below the surface. A limited range for wireless transmissions can be obtained from periscope depth, by a small

aerial fixed to the Radar mast. One way in which a submarine when dived, can keep continuous touch with the shore base, is for a ship fitted with Asdic to be in the vicinity. Messages can then be transmitted to the surface ship by Asdic, which in turn can transmit it by wireless in the normal way. On the surface, the submarine is able to transmit wireless messages in the same way as any surface vessel.

Asdic

The device known as Asdics, used extensively in surface craft to detect underwater objects, is also fitted in submarines to enable them to

(a) Detect approaching surface craft, when submerged.
(b) Communicate with other craft when under water.
(c) Detect other submarines.

Radar

All submarines are now fitted with Radar which when on the surface is used in the same way as in surface ships. Radar masts can also be projected and the sets worked when the submarine is proceeding submerged at periscope depth. It must however be appreciated that whether it be Radar masts, periscopes or the snort mast when raised, all are subject to detection by enemy radar, and as such may only be used if the Commanding Officer is satisfied that the risk of being detected is acceptable.

Mines

Apart from submarines specially designed for Minelaying, and which can carry a large number of mines, the normal submarine can carry about 12 mines. These can be laid one at a time from each torpedo tube, and are fired in the same way as a torpedo.

Answers to Some Popular Questions

A question which is usually asked is "Is it rough under the water?" The fact is that as soon as the submarine is under the trough of the waves, it is generally calm inside the submarine. The exceptions are when the surface sea is remarkably rough, and there is not sufficient depth of water. Generally speaking however, if the submarine submerges to, say, a depth of forty feet and there is a big sea running on the surface, the submarine itself will be absolutely still and no movement experienced. If on the other hand she dives to the bottom of the sea, the chances are that there is a ground swell which will destroy this tranquility.

Another common question which comes to the mind of a layman is one relating to air required for breathing. It is difficult to believe, but

nevertheless true, that some 70 men inside a submarine can go on breathing the same air for several hours. The reason is that the increase in Carbon-di-oxide in the atmosphere of a submarine, during a prolonged dive, though causing slow poisoning, takes many hours to have any serious ill effect. Long after it is impossible to strike a match or smoke a cigarette through lack of pure oxygen, human beings can work and what is more important, they can think. In a modern submarine, it is not until the air has been breathed for some 15 hours that there need be any distress. With the snort mast now available to let in air when at periscope depth, there is no necessity for a submarine to surface at all. There are means provided for easing the position, if no fresh air is available for long periods. Chemical canisters are fitted in the ventilating trunking, which absorb the Carbon-di-oxide gases in the atmosphere. Side by side with these are used candle oxygen generators which replace the oxygen content in the atmosphere lost through the process of breathing. One canister and one candle are kept at each end of the submarine and are only used at the discretion of the Commanding Officer.

Modern submarines are so well ventilated that the danger from any gases or fumes is almost entirely avoided. The gas for which submariners have the greatest respect is Hydrogen. It is potentially the most dangerous gas that may be found in submarines to-day, and is given off when the electric batteries are being charged or discharged at a very high rate. This hydrogen is dispersed by very carefully thought out ventilating systems, but faulty drill may cause pockets of hydrogen to remain in the vicinity of the batteries. Any naked light or an electric spark in the vicinity can lead to a violent explosion.

Another dangerous gas is Chlorine which is the result of salt water mixing with Sulphuric Acid used in the batteries. The fact that a submarine spends almost its entire life under water and that there are many tons of Sulphuric Acid carried in the batteries, tend to make a risky situation. Nevertheless, with proper attention to rules and careful checking of ventilation systems, accidents should not occur.

Smoking inside a submarine is normally allowed when on the surface or when snorting, but is not allowed when dived without using the snort. After about twelve hours under the surface without replenishment of fresh air, no smoking is possible in any case as it would be impossible to light a match or draw on a cigarette !

The ability of a submarine to remain at sea for long periods is at present primarily governed by the amount of oil fuel and lubricating oil carried. For a 'Snort' fitted craft, it is not uncommon for it to remain at sea for months, and to cover a distance of many thousands of miles. Human endurance, food and water are at present not the limiting factors in determining endurance. It is quite possible, that with the advent of Atomic submarines, with greatly increased mechanical endurance, the deciding factor may once again become the physical endurance of the crew to withstand the conditions of living under the sea for long periods.

Accidents

The submarine is an easily vulnerable vessel and even in peace time operates under conditions approximating to war. As such, accidents have occurred from time to time in submarine work, both by the very nature of the craft, and since risks have to be taken when training with weapons of war.

One of the most common causes of accident in the past has been collision with surface ships when submerged. Unlike a surface ship a submarine when submerged must of necessity have a low buoyancy. Even a comparatively small amount of water admitted into the pressure hull will therefore soon destroy this buoyancy and cause the craft to sink. A collision at sea is therefore something that a submarine cannot risk. For greater safety, a modern submarine has a diving depth, due to long periscopes, which will allow all except the deepest draft vessels, to pass over the boat without danger to the pressure hull. Failure on the part of the crew to keep the depth ordered, through a sudden change in trim, can however, lead to a dangerous situation.

The period when a new submarine is undergoing trials, or an old one is being refitted, is always a testing time. This is a time when the crew have either not had the necessary length of time together to be moulded into a well knit unit, or are a skeleton crew on board as is usually the case when a boat is being refitted, that accidents are particularly likely to occur. The only answer is to take every possible step to check that orders are carried out without fail and no mistakes are allowed in the drill.

There is not sufficient evidence to prove that material defects have been the direct cause of any of the recent submarine disasters. Sometimes the material may be taxed beyond its capabilities, but such a contingency should not normally arise in peace time.

Gases in submarines have been the cause of several accidents. A severe hydrogen explosion can bring immediate disaster, but correct drill and constant checking of the battery ventilating system should eliminate this, certainly in peace time.

To sum up, it can be said that there is no greater risk in submarine life than in most walks of life outside the office chair, provided that at no time is there any relaxation of drill and care.

Conclusion

More than in any other branch of the Navy, it is easy to see why each man in a submarine must have a perfect knowledge of his job to make up a really efficient submarine crew. The life is hard and arduous and danger is ever present round the corner, and yet service in submarines is popular and sought after.

One reason for this is clearly the great comradeship that exists in the submarine service, and among the submarine crews. Living in close proximity for days if not months at a time, officers and ratings in the submarine service come together more closely, than in most walks of service life. The history of submarine services during the two wars, which is full of exploits of courage and devotion to duty has established traditions for the service which is perhaps its greatest attraction.

The young submarine officer gains considerable practical experience of ship handling, navigation and torpedo work, coupled with a close understanding of the sea and weather, long before his contemporaries on surface ships. It is not surprising then to find a larger proportion of submarine officers rising to the higher ranks of the Navy. Lastly, there is always the attraction of an early command.

THE BATTLEFIELD OF PANIPAT

FLIGHT LIEUTENANT D.R. SETH, I.A.F.

THE historic town of Panipat, some fifty miles north of Delhi, is the hub of the sacred region of Kurukshetra. It was here, in ancient times, that the battle of the Mahabharata was fought. It was here, in the Middle Ages, that the three battles of Panipat were fought, giving a new twist to the history of India each time.

There is a reason for all this. Till the coming of the British, the only entrance into India was through the mountain passes on the north-west frontier. It was through these passes that the Aryans came, to be followed by the Greeks, the Sakas, the Parthians, the Kushanas, the Hunas, the Turks and the Afghans. To the invading conqueror from the north-west the Punjab was the entrance hall of India. To proceed from it to the basin of the Ganges, he had to cross the Sutlej and to come on to the upper Jumna above Delhi. There was not the least hillock between the spurs of the Himalayas and the northern point of the desert of Rajputana which extended to the Arabian Sea and through which no invading army could pass. Thus the narrow passage, between the Jumna in the east and the desert in the west became a strategic point of the greatest importance, the only point where the invader could be checked by the ruler of Delhi. No wonder, thus, that the destinies of India were decided here so many times.

THE FIRST BATTLE OF PANIPAT (1526)

The first battle of Panipat was fought on April 21, 1526 between Sultan Ibrahim Lodi, ruler of the Lodi Empire and Babur, King of Afghanistan. It was one of the most decisive battles, decisive in the sense that Babur's victory led to the foundation of the Mughal Empire in India, and changed the history of the country for the next three hundred years.

Historical Background

The dawn of the 16th century saw India divided into a number of states. In the north and north-west was the Kingdom of the Lodis comprising Behar, U.P. and the Punjab. In the east was the Kingdom of Bengal ; in the west the independent princes of Rajasthan ; in central India

the Kingdom of Malwa ; in the south-west the Kingdom of Gujrat, in the south the Empire of the Bahmanis which was in the process of disintegration and further south the Empire of Vijayanagar at the height of its glory. The country was thus divided and weak. There was no unity between the various states. Internecine warfare was the order of the day.

In Afghanistan a new star had arisen. Babur, a descendant of the great Taimur, after being turned out of his paternal Kingdom of Ferghana by the rising power of the Uzbegs, had in 1508 conquered the Kabul valley and gradually succeeded in establishing his authority over the provinces of Ghazni, Kandhar and the area of north and north-west Afghanistan. War and conquest were in his blood and once secure in his seat he began to cast longing eyes towards India and to dream dreams of conquest. His first four attempts were mere pin-pricks but the fifth and last one was the real thing. Babur left Kabul in the closing months of 1525 and marching along the foot-hills advanced towards Delhi.

On April 12, 1526 Babur reached Panipat and hearing that Sultan Ibrahim Lodi was advancing towards him decided to offer battle there. The place had several advantages. It was a flat plain good for cavalry and the town and suburbs of Panipat on his right would afford protection from attacks from that flank. To avoid surprise he fortified his camp. In front were placed the guns which were connected together with twisted bull-hides. Between every two gun-carriages breast-works were put up. Matchlockmen and infantry were placed behind the guns. On the left the camp was protected by ditches and felled trees. At the distance of every bow-shot a space was left large enough for a hundred or a hundred and fifty men to issue forth. Babur's army including camp followers totalled not more than twelve thousand men.

Sultan Ibrahim Lodi, when Babur's intentions had become clear, had advanced from Agra to meet him. He had about a hundred thousand men and a thousand elephants with him. Ibrahim was a young man with no experience and it was his misfortune to have as his adversary a man who was perhaps the greatest soldier of the age. There was no unity but plenty of disharmony in his army and many of his leading nobles were ready to change sides at the slightest indication of the day going against him.

The Battle

The two armies lay facing each other for about a week. During this period small parties of Babur's men would advance close up to the enemy

and discharge arrows upon them. At length Babur decided upon a night attack for the night of 19th April. Four or five thousand men sallied out but they failed to achieve surprise and continued to linger near the enemy's camp till it was broad daylight.

It was the morning of April 20, 1526. Ibrahim's army got ready and advanced towards the attacking party and forced them to fall back. On learning what had occurred Babur despatched Humayun to cover their retreat and ordered the rest of the army to be ready for action. The party which had marched to surprise the enemy fell in with Humayun and returned with him. As Ibrahim's men did not advance further Babur drew off his army and led it back to camp. That night there were many false alarms.

The next day was the 21st of April—a fateful day. With the first light news was brought to Babur that Ibrahim's army was drawing up in order of battle. Babur too got ready. He arranged his army into right, left and centre divisions. On the flanks of the right and left divisions flanking parties were placed with instructions that as soon as the enemy approached sufficiently near, they should make a circuit and come round upon their rear.

The battle opened up with Ibrahim's troops marching up at a quick pace. But when they saw Babur's army drawn up in battle order they slowed down their speed. At this Babur sent orders to the troops stationed as flankers to wheel round the enemy's flanks and attack them in the rear. At the same time the right and left wings were also ordered to charge the enemy. The battle was then fully joined. At first Babur's left wing seemed to give way but the situation was restored when reinforcements were rushed to its aid. On the right too the fighting was obstinate. The guns in the centre were then ordered to advance and fire upon the enemy. They did fearful execution among Ibrahim's men and he had nothing to retaliate with.

Ibrahim and his army fought very gallantly but the superior generalship of Babur proved their undoing. Soon Babur ordered a general advance and his right, left and centre divisions and the flankers surrounded Ibrahim's army and attacked them from every side. Ibrahim's right and left divisions were driven upon his centre and his whole army became a disorganised mob unable to advance and unable to flee. Thousands of them were killed, Ibrahim among them, and thousands captured. The fighting was over by midday and the Empire of India had changed hands.

The Second Battle of Panipat (1556)

The importance of the second Battle of Panipat lies in the fact that it was victory in this battle that led to the real establishment of the Mughal Empire in India. Babur had not lived long enough to do anything more than subdue parts of northern India. Akbar was the real founder of the new order of things.

Historical Background

The Empire of India won by Babur at Panipat in 1526 was lost by Humayun fifteen years later. But he succeeded in regaining what he had lost after another fifteen years. Unfortunately he died soon after, leaving not much of an inheritance to his son Akbar.

Akbar was faced with a very difficult situation. The princes of the House of Sher Shah still pretended to the throne of Delhi. These were Adali who had occupied the throne for about a year, his cousin and brother-in-law Ibrahim, who had dethroned Adali in 1553 and Ibrahim's cousin and brother-in-law Sikander, who expelled Ibrahim in 1554 and was defeated by Humayun at Sarhind in 1555 and driven from Delhi and Agra.

After the enthronement at Kalanaur, Akbar and his guardian Bairam Khan remained in the Punjab, for some time, where Sikander Sur was still in arms. But soon they were faced with a foe more dangerous than Sikander. This was Himu, a Hindu of Rewari, whom Adali had made his minister, an able, energetic and ambitious soldier who was preparing to expel the Mughals from India. He commanded a large force of Afghans.

When Himu advanced from Gwalior towards Agra the Mughal Commander Iskander Khan retired towards Delhi to join forces with the Commander there. The two then offered battle to Himu but were defeated and abandoning Delhi retreated towards Sarhind. Ali Quli Khan at Sambhal also fell back on Sarhind as he felt that he could no longer maintain his position after Himu's occupation of Delhi.

The news of the fall of Delhi and Agra reached Akbar and Bairam Khan at Jullundur. Most of the courtiers and officers advised an immediate retreat to Kabul urging that it was folly to attempt to withstand Himu. Bairam Khan decided, however, to risk all in the attempt to recover Delhi and persuaded Akbar to adopt his view. On 13 October, 1556 the imperial army marched to Sarhind.

The Battle

Himu elated by his victories and the capture of Delhi advanced northwards when he heard of the approach of the Mughals. He sent forward his advance guard with the greater part of his artillery to meet that of Akbar which had marched on Panipat. The Mughal advance guard inflicted a severe defeat on Himu's and captured his artillery.

Meanwhile the main bodies of the two armies were in motion and met on 5 November, 1556 on the historic plain of Panipat.

Both sides arranged their forces in the traditional manner, with right, left, centre and advance divisions. Himu's army greatly outnumbered the Mughals and had also a large number of war elephants.

The battle began when Himu advanced with his elephants and made such a determined charge on the Mughals that their left wing was shaken. But by the exertions of the brave archers and by the resolute use of spear and sword Himu was prevented from breaking it. Baulked, Himu drew off his forces and made an assault upon the centre. He led all his elephants against it and was again met with a shower of arrows. The Mughal commander and his men taking every advantage of the unevenness of the ground fought with the utmost valour but would certainly have been overpowered had not an arrow pierced the eye of Himu and come out at the back of his head. When those who were fighting under him saw his condition their courage failed and they fled from the field of battle.

The driver of the elephant on which Himu was riding, made off towards the jungle to carry his master beyond the reach of danger. Shah Quli Khan a Mughal captain came up with this elephant and on being told who the injured man in the howdah was caused him to be led to Akbar. When the wounded Himu was placed before the young Akbar, Bairam Khan prayed him to earn the title of Ghazi by slaying an infidel with his own sword, and the emperor severed Himu's head from his body, or according to another story merely touched Himu who was then slain by those in attendance.

Troops were sent in pursuit of the flying enemy, and followed them with great slaughter to the gates of the capital which was secured. Two days later Akbar entered Delhi.

The victory was complete. Any prospects of establishing Afghan rule in India disappeared for ever. The Mughals became firmly seated in the

saddle and a period of expansion and prosperity, encouraged and inspired by the genius of the great Akbar, began.

This battle was thus one of those single incidents that change the course of history.

The Third Battle of Panipat (1761)

The Third Battle of Panipat was fought between the Mahratta army under Sadasiva Rao Bhao and the Afghan army of Ahmed Shah Abdali assisted by the Nawab of Oudh and other Afghan chiefs of India. The defeat of the Mahrattas in this battle made the establishment of a Mahratta Empire in India impossible.

Historical Background

During the half century following the death of Aurangzeb (1707) the Mughal Empire went to pieces. His successors, who followed each other in quick succession, were weak men who exercised no control over the affairs of state. Provincial governors became independent to all intents and purposes and founded dynasties. The scramble for power became a free fight for all. Of the Indian powers the Mahrattas had the best chance, but they were feared and opposed by the Muslim chiefs who were prepared to side with a foreigner against their own countrymen.

The foreign participant in the race was Ahmed Shah Abdali the ruler of Afghanistan. His first few attacks on India proved unsuccessful, but he was a persevering man who came again and again till he succeeded in sacking Delhi in 1756 and annexed the whole of the Panjab north of the Ravi to his dominions. As soon as Ahmed Shah's back was turned a Mahratta force appeared under Raghunath Rao the Peshwa's brother and drove out the Abdali's garrisons from the Punjab.

In 1759 the Abdali reappeared again, drove out the Mahratta garrison at Lahore, and advanced on Delhi. The Mahratta forces round the capital tried to resist him but were defeated at Barari Ghat, ten miles north of Delhi in the beginning of January 1760. The news of the defeat reached the Peshwa on 15 February, and he at once despatched a new army to restore Mahratta influence in northern India. This army was under the nominal command of the Peshwa's heir Vishwas Rao, but the real Commander was Sadasiv Rao Bhao, the Peshwa's cousin.

The Mahratta army reached Delhi at the end of July and occupied the capital. After leaving a garrison there the army advanced north towards

Kunjpura a centre of the Afghan faction. This place was taken by storm while Ahmed Shah on the other side of the Jumna had to look on as he could not cross the flooded river. But shortly afterwards he found a ford at Bagpat, crossed the Jumna and interposed his army between the Mahrattas and Delhi. This was on 25 October. The Mahrattas came up soon after and were repulsed with loss. They fell back on the little town of Panipat where they proceeded to dig themselves in, throwing up a broad rampart with a ditch in front of it and mounting cannon at regular intervals. By this fatal move the Mahrattas lost the initiative and sacrificed mobility which was their most valuable asset.

The Battle

The space between the two opposing lines became the scene of almost daily skirmishes, horsemen riding out challenging their foes to single combat and a number of fierce actions developed from chance encounters. The main efforts of the Abdali were directed towards blockading the Mahratta camp and thus starving them. All attempts at reinforcing the camp were defeated and foraging parties going out to collect food and fodder were cut up.

The effect of this pressure told on the Mahratta camp towards the end. Hundreds died for lack of food and an epidemic broke out due to the absence of sanitation in the vast host cooped up in that narrow area. So it was decided to deliver a general assault on the enemy's lines.

It was the 14 January 1761 when the Mahratta army came out of their camp and advanced slowly, the ends of their turbans loose and their faces anointed with saffron—a sign that they had come out to conquer or to die. The Bhao with Vishwas Rao rode in the centre with Ibrahim Gardi with his regular battalions and the Gaekwar on the left, and on the right were posted Holkar and Scindia. The Afghan centre was commanded by Shah Wali Khan, Abdali's chief minister, on the left flank were Shah Pasand Khan and Najib-ud-Daula and Shuja-ud-Daulah, and on the right Burkhurdar Khan with the Rohilla and Mughal contingents.

The two lines advanced obliquely on a front of seven and a half miles, the Mahrattas left under Ibrahim Gardi making contact first. The battle began with a fierce discharge of artillery and rockets all along the line, but the Mahratta gunners fired high and the shots flew harmlessly over the heads of the Afghans. Ibrahim Gardi thereupon ordered the guns to cease firing, and closed with his opponent with bayonet. After a fierce struggle

the Rohillas were pressed back and the Afghan centre exposed. The Bhao seeing his opportunity charged into the gap with the whole of the household cavalry at full gallop. The impact was incredibly violent and the Mahrattas broke through three lines of their opponents. Nothing could be seen due to the clouds of dust and only the opposing cries of "Har, Har Mahadev" and "Din, Din" could be heard.

It now looked as if the battle was going against the Afghans. Their right flank was turned and their centre was broken: only on their left were they holding on. Here Najib-ud-Daulah was opposing his old enemy Scindia. From dawn to midday the engagement raged with the utmost fury and at any time the line might give way. But the Abdali knew that the commander who throws in his reserves last wins. The psychological moment had now come. He brought up his fresh reserves. He then posted 4,000 men to cover his right and sent 10,000 to the centre with orders to charge with the sword in close order at full gallop. Najib-ud-Daulah was directed at the same time to attack the Mahratta centre from the flank. Meanwhile, the mounted infantry galloped along the enemy's line, firing from their saddles into their closed ranks.

The simultaneous counter-attack was launched all along the line early in the afternoon. It was excellently timed, and its effect on the Mahrattas was terrible. Men and horses were tired but they still contested the ground inch by inch. About 2.15 p.m. Vishwas Rao was wounded and had to be taken to the rear, but the Bhao still fought on at the head of his men for an hour longer. Then with dramatic suddenness, resistance collapsed and the Mahratta army melted away. The victors pursued them to their camp, giving no quarter. Next morning the Mahratta camp was stormed. Countless Mahrattas became martyrs, Vishwas Rao and the Bhao among them.

Conclusion

The three battles of Panipat should be of interest to all students of military history. The region between Panipat and Delhi has not played out its part. Its strategic importance remains in any future conflict. The face of warfare might have changed but the principles of strategy do not change. This is especially true of land strategy. The numbers of fighting men engaged in modern battles have increased ten-fold or may be a hundred-fold; the weapons of war have developed and become a thousand times more destructive, but the guiding principles of war remain eternal.

WITH PEGASUS IN INDIA*

ERIC NEILD

THE situation was now desperate; the village of Sangshak a shambles and the area so congested that the Japanese shelling was disinterring the dead. Water was gone, ammunition almost exhausted, and there was no sign of relief. We were so tired that we were mere automatons as we worked to shorten the perimeter, to move the wounded in the field ambulance to a site which was not subject to small arms fire and to carry out burials of so many friends of the past three years.

That evening, just as we were about to stand-to, a runner came round —conference with the C.O. immediately. We had a long crawl on our bellies to the command post on the hill which had once belonged to the gunners. Here, we heard startling news—that night, action was to be broken off, the whole brigade to move bodily south through the jungle until six-thirty next morning when we should face west, and march until we reached the safety of Imphal. It was only thirty miles as the crow flies, but many times that distance by the tortuous jungle tracks. The Corps Commander's message ended—"Good Luck, our thoughts are with you." At that moment, the field telephone rang. It was Abbo for Dick Willis—"See you in Imphal with a bottle of beer!" We smiled wanly, both contingencies seemed highly remote. A few terse orders re destruction of mortars and wireless sets and details for stretcher-bearers for the field ambulance, and then we dispersed.

The night was quiet, no 'whizz-bangs'. The minutes ticked by and at half-past-ten, we got silently out of our bunkers into the pitch darkness of a moonless night. As the Japs were astride the path which led to the south, we simply dropped down the side of the hill some fifteen hundred feet to the southeast and were swallowed up in the jungle.

* * * *

Those Naga Hills—what memories they hold. It was seeing the "Everest" Film the other evening that brought it all back so vividly. The

* Reproduced by courtesy of *Pegasus*—the Journal of the Airborne Forces, Aldershot (*Ed*).

wild terrain of the approach march, and then at the base camp, I really had to rub my eyes for there was Jimmy Roberts, one of our company commanders arriving with the rear party carrying the reserve oxygen cylinders from Katmandu. From Nepal, it was but a step in reverie to other wild hills, this time in Korea. There Rangaraj, the first Indian Officer to parachute, had been commanding that world famous unit, the 60th Indian Parachute Field Ambulance. Surely he must have the longest continuous parachute service of any officer in the Commonwealth.

It was in Delhi towards the end of 1941 that the 50th Indian Parachute Brigade was formed, consisting of the 151st British, 152nd Indian and 153rd Gurkha Battalions. The 151st, later to be renumbered the 156th in the Middle East, was commanded by Lt-Colonel Martin Lindsay, followed by Lt-Colonel "Socks" Hose, and other well-known names were Dickie Lonsdale, George Lea and Bertie Bevan. The 153rd, then commanded by Lt-Colonel Loftus-Tottenham, afterwards to command the 81st West African Division, was presumably where the apocryphal story of Gurkha parachute recruits originated.

It went something like this :—

Shortly after the formation of the battalion, three rather worried looking Gurkhas applied for an interview with their company commander. On this being granted, they told him that they had been thinking (a rare occurrence) and had come to the conclusion that six hundred feet was rather a height to jump from and that they thought three hundred would be more reasonable. The company commander pointed out that the disadvantage of three hundred feet was that the parachutes might not open. "Oh," said the Gurkhas, "so we have parachutes !"

When I reported in November of that year, the brigade staff was hardly an encouraging advertisement for any embryo parachutist. The commander, Brigadier Gough, with only one eye, was hobbling around on sticks on account of a compound fracture of his leg sustained on his last jump at Ringway. The B.M. "Hoppy" was in a plaster spica—he had broken his back after being dropped on the concrete outside the hangar at Drigh Road Aerodrome, Karachi, when he made the first statichute jump in India with Lt-Colonel Abbott (152nd) and Sqdn. Leader "Big-Bill" Brereton (Chief Landing Instructor at the A.L.S.).

Jumping was quite an event and most people who could, used to down tools to watch it, usually in the varied company of allied Generals and

Indian potentates. Equipment for parachute training consisted of twelve 'X' type parachutes, an out-of-door trapeze and the "mock-ups" were the aircraft themselves. These consisted of a flight of Vickers Valentias, twin-engined biplanes, which were reported to have been built in 1922. Courses lasted a fortnight with a prior week of P.T. There were thirty men per course, and five jumps were necessary to qualify for "wings". As there were only 12 'X' type parachutes in India, it was necessary to use some of them twice a day; this without any proper drying facilities whatsoever. And of course parties always seemed to finish with the restaurants Hakmann's and the Astoria in New Delhi being broken up with monotonous regularity to the consternation of the locals.

As a change from intensive training over the hot barren plains around Delhi, each battalion in turn was sent down to do combined operations on Kharakvasla Lake near Poona, and from here we had the run of the magnificent Mahratta hill country and their impregnable hill forts. It was from here that Jimmy Roberts left to drop with a party near Myitkyina, and, at this time that a company of 152 was sent to help round up the Hurs, a lawless tribe, in the Sind Desert. This, according to Field-Marshal Lord Wavell, was the first use of parachutists in internal security operations. In August, the Indian political situation which had been bubbling for some months following the Cripps Mission, boiled over and the brigade, the only force available, was immediately deployed to maintain law and order for three weeks in Old and New Delhi.

But change was in the air, and owing to the increased importance of Delhi as a nodal air junction for the Burma theatre of operations, the A.L.S. in October had to move further afield to Chaklala in the N. Punjab and we to Campbellpur near the river Indus at Attock. Here to replace 151, a fourth battalion, 154th Gurkha, was formed from the remnants of the 3/7th Gurkha rifles (one of the surviving units from the Burma retreat of 1942). In spite of the arrival of more aircraft—some Hudsons and a squadron of Wellingtons—the cold weather 1942-43 was a depressing period owing to the number of unexplained fatalities. It speaks volumes for the morale of the brigade that training went on in spite of the death rate—almost one per course, now a hundred. When morale was particularly wobbly, Brigadier Hope-Thomson used to take the whole brigade staff up and do a 'snob-stick'. Eventually Group-Captain Newnhan came out from home and following his recommendations, the accident rate rapidly declined.

Hot weather training in Campbellpur was both trying on the temper, as the temperature even at night did not drop much below 100°F, and wearing physically, as exercises, entirely on foot, were carried out over country which was mainly sandy soil. We welcomed with enthusiasm the visit of Generals Auchinleck and Browning, and were practically promised operations in the immediate future, and to implement the promise a wing of Dakotas arrived. But, alas, what we did not know was that the promised landing craft for the new amphibious offensive were already being diverted to Italy. As a sop, 152 and 153 were sent early in 1944 to Kohima, to carry out advanced jungle training. How advanced it was to be, perhaps, only the Japs could have told us at that time.

We had been there less than a fortnight when things were obviously happening. We were hurried down to Imphal some eighty miles away and then sent up towards Ukhrul to join 152 and the rear party of the 49th Indian Mountain Regiment I.A. and the 128th Jungle Field Regiment R.A.—both of whose commanding officers were soon to be killed in the defence of their guns. Almost immediately contact was made with the Japanese at Sangshak and a violent battle ensued. Every night they attacked, although they were quiet during the day. All supplies were short, particularly water. Attempts were made to air supply, but the dropping was inaccurate. It was maddening to see two-thirds of the supply containers falling into Japanese hands. On the fifth night, after a particularly heavy attack, the Japanese broke into the perimeter, and it was only after six hours of savage hand-to-hand fighting that they were thrown out. The position was now desperate—of 25 British officers of 152 who had gone jungle training to Ukhrul a fortnight before, only two were unwounded, and eighteen had been killed. Water was gone, and there was no sign of relief. That evening, as has already been recounted, orders arrived to disengage, the brigade broke up into small parties, each carrying their own wounded, some of whom took ten days to reach Imphal.

Arriving back on the plain, we found that its north-eastern approaches had been blocked by 5th Indian Division, flown in from Arakan. Here we were to remain, after reorganisation and now under Brigadier 'Lakri' Woods, several months, holding positions in various sectors. On it life assumed a semi-troglodyte existence. A main pre-occupation was to mitigate some of the more trying aspects of the monsoon. Being air-supplied, the ration was about sixty per cent of normal, the bulk rice and

dried biscuits, the cigarette issue being "V"s ; newspapers arrived in batches three or four days late, and the most welcome amenity of all was mail from home. Shortly before the Kohima road was re-opened in June, we returned into those hills to have the pleasure of harrying the Japs in their retreat.

Space does not permit to tell of our return to India, our absorption into the Indian Airborne Division, then forming under General Down at Secunderabad, which was later to come under the 1st Indian Airborne Corps, General Gale with B.G.S. Brigadier Bourne. While this tremendous reorganisation was taking place, it became suddenly necessary to mount a parachute operation to neutralise the coastal guns at Elephant Point, commanding the entrance to the mouth of the Rangoon River. This although nominally a divisional operation, was the swan-song of the original 50th P. Brigade, affectionately known as "Prune". A composite unit from its old battalions was formed, landed and carried out its appointed task. While the battalion was taking part in the victory march through Rangoon, the news of the end of the war in Europe was announced.

The vast strides in technical achievements made by the Indian Army during the war are not, perhaps, always fully appreciated. It is necessary to remember that, at the outbreak, only a handful of units were mechanised, the rest marched on foot with mule or horse transport, while the vast majority of Indian soldiers had never seen an aeroplane, let alone been inside a petrol-driven vehicle. Yet, at the end of the war, the Indian Army had its armoured, commando and parachute formations. It was indeed a privilege to have served with such men. And when we reflect on the memorial to the British 2nd Division at Kohima, we think also of many others :—

"When you go home,
Tell them of us and say,
For your tomorrow
We gave our today."

REVIEWS

THE ARAKAN OPERATIONS 1942-45

GENERAL EDITOR

DR. BISHESHWAR PRASAD, D. LITT

Combined Inter-Services Historical Section (India & Pakistan), Rs. 20/-

This book is the second volume to be published in the series prepared under the Official History of the Indian Armed Forces in World War II, the first being the Retreat from Burma. It deals with the campaigns in Arakan against the Japanese from the time of the first Allied invasion at the end of 1942 till the last Japanese was cleared from Arakan in May 1945. Although the Arakan campaign was fought in a well defined sector, it was part of the overall strategic picture of the campaign in Burma. Hence while the focus is on Arakan this relationship has been well brought out in the present volume.

The earlier battles in Arakan had a defensive aspect directed to the holding of the Maungdaw-Buthidaung line so as to prevent the Japanese from launching an invasion into the Chittagong area, although at every stage the capture of Akyab was the aim. Akyab was important for any advance into the valley of Burma because it provided a base from which such an advance could be maintained. Out of the context of the advance in the central sector the capture of Akyab had no strategic meaning. Its importance to the Japanese was that it was denied to the Allied forces.

The first offensive was planned in haste and was supposed to be an auxiliary to the main attack in the central sector. The main attack did not go in and a sea-borne invasion of Akyab was ruled out as shipping was not available. With untrained troops it was decided to advance on Akyab by land which course precluded all possibility of surprise. After a limited initial advance gained at the cost of considerable casualties and expenditure of material, at the end of 1942 the Allies were no further forward than where they started.

The Japanese counter-offensive commenced in March 1943 and was directed against the Maungdaw-Buthidaung road which carried the

maintenance of all the troops in the Mayu valley and provided the only means of switching forces across the Mayu range by motor transport. The critical area of defence of this road was in the "Tunnels" where the road crossed the summit of the range. After this area was captured the troops at Buthidaung were cut off from Maungdaw which also had to be abandoned.

Early in 1944 it became apparent that a large-scale Japanese offensive designed to destroy the whole of XV Corps was imminent. All forces were ordered to hold their ground even though by-passed and the bold decision of supplying them by air when encircled was taken. This had a vital effect on the battle. The morale of the troops remained high in spite of fighting in encircled "boxes" because they realised that though surrounded they were never isolated. Against these tactics the Japanese counter-offensive collapsed because their administrative requirements could not be sustained. Air supply was to be used far more successfully a few months later at Imphal.

By March 1944 the Allies were able to resume the offensive and after a series of uninterrupted successes, the whole of Arakan was cleared of the enemy.

The Arakan campaign is important in that it was the first occasion when large-scale air supply was successfully used as an answer to infiltration tactics. It also provided opportunities for small-scale combined operations.

This is a factual account of the operations compiled from numerous sources both Allied and Japanese. It offers good scope for the study of minor tactics.

J. N.

THE GERMAN GENERAL STAFF

WALTER GORLITZ

Hollis & Carter, London 30/-

This is a comprehensive history of the development of one of the most remarkable institutions in the annals of warfare—the great General Staff of Prussia and later of Germany. It takes us back to the year 1657, when Prussian military leaders first discovered the necessity of an efficient and professionally trained body of military experts to be attached to each Field

Commander as well as to the Head of the State. In the traditional Absolute system, all Staff work as we know it emanated from the Head of State, who alone was responsible for the formulation of military plans, the working out of staff details and the direct issue of detailed orders to all subordinates.

Conceived by Scharnhorst and Clausewitz, but actually effectively and firmly established by the elder Moltke, the great German General Staff became and remained the most powerful unit in later German history. The book contains interesting and intimate pen-pictures of some of the distinguished personages amongst the ranks of this military clique throughout its variegated history from the earliest days right up to 1945—Scharnhorst, Gneisegnau, Clausewitz, the two Moltkes, Waldersee, the Hindenburg-Ludendorf team, Keitel, Jodl and Guderian are but some of the few of this illustrious cadre.

The development of the system of planning and command during war is an object lesson to us who are still trying to find a democratic yet practical process of military command and control—both in peace and war. Indian statesmen attempting to understand the ways of military command would be well advised to make a study of the evolution of the German General Staff system, the ills which attended it, the grim though fascinating history of its achievements, and its final collapse under a paranoic leader who persistently disregarded the advice offered by this highly professional cadre.

The decay of the German General Staff was entirely due to Hitler's distrust and disregard of the Junkers. It begins with the setting up of the High Command of the Wehrmacht (O.K.W.). Superficially, a command of this sort (as pointed out by Mr Cyril Falls in his Preface to this volume) to co-ordinate the operations of all fighting forces, is attractive. But any system which puts policy and strategy in one set of hands and responsibility for the separate services in another must be inherently vicious. The British and Allied system of Chiefs of Staff Committees avoided this weakness; each Chief functioned in a double capacity—separately as regards his own service, and in Committee as joint framer of military policy and strategy, and military adviser to the Government.

The last few chapters of the book are exceptionally interesting and includes the famous ill-fated plot of July 1944, which was undertaken in the main by the General Staff. This was however, as the author points

out, no isolated gesture of defiance. Out of 800 officers, 150 (or nearly one-fifth of the total) of the General Staff fell in the struggle against Hitler. And this in itself was characteristic of the Junkers of the General Staff all through its history—it would not accept a national policy which it did not consider in the interests of Germany. To the end, the German General Staff remained a law unto itself.

D.K.P.

AFRICAN ADVENTURES

ALEXANDER LAKE

Whallen, London, 15/-

From the adventures of a seasoned white hunter comes one of the most exciting hunting books of all time. This is a book which will be of interest to the shooting enthusiast, as well as to all lovers of adventure stories ; for parts of this book read like a story by Oppenheim—an international intrigue, a murder mystery in the jungle, a colossal sporting bet which involved human lives. At times it is difficult to remember that one is reading a factual account, for the pages of Mr Lake's book take one through a range of fascinating out of the way adventures.

Not the least exciting of the series of adventures related in this book are the efforts of a Zulu warrior to collect the trophies of a Crocodile, Elephant, Lion, Hippo and Buffalo, using only an axe. This was for a 10,000 dollar bet. And to make matters more interesting, the Zulu was one of those sportsmen who considered that to take any unfair advantage over an animal was the work of 'fat women'. He therefore liked to kill crocodiles in the water rather than on dry land.

The author goes a bit primitive in giving us his range of recommended cuisine for the jungle, especially for sportsmen who have hunted amidst the squeamish prejudices of Indians, to whom most meats are unclean. Mr Lake includes in his chapter on 'How to Cook a Crocodile', such choice and succulent dishes as 'Python Yarborough', 'Jugged Lion', 'Frog-legs Uganda', 'Baked Hippo Ham', and 'Crocodile a la F. Robinson'. He himself has often cooked and eaten cobras, lions, leopard and other weird meats. Even crows and vultures are to him eatable game.

In spite of the author's outlandish tastes in the matter of table meat, the book is a fascinating departure from the average shooting or safari account. There are a number of excellent photographs. A book well worth reading.

D.K.P.

BIG GAME RIFLE

DR. HENRY M. STEBBINS

From over forty years of shooting experience, Dr Stebbins has gleaned a rich harvest of useful information on sporting rifles of American manufacture. Sportsmen in India have been concerned mostly with British sporting weapons in the past. With the advent of our American friends in large numbers, especially since Independence, the advertisement columns for second-hand sporting weapons have been filled with rifles and guns of U.S. make, and it is therefore all the more important for us to know something of the history and development of these weapons. For although American arms have never been able to compete with the really good class weapons made by the well-known London gunsmiths, the prohibitive cost of the latter in the post-war market will drive more and more Indian sportsmen to the cheaper American weapons.

With his long background of familiarity with sporting arms, the author offers the reader his considered appraisals of old and new rifles and ammunition. The information has been served up in compact and entertaining form, with a host of clear and useful information. Starting with the Lever Action rifles (long a favourite with certain classes of American sportsmen), the author takes us through the better known Bolt Actions, then to the controversial 'Pumps' and Automatics, the Single Shots and finally to the various types of recommended ammunition. The book also includes a very informative chapter on hunting sights, both iron and telescopic.

Unfortunately, the book has no place for the double-barrel weapon, since the United States have never been able to produce a double-barrel rifle satisfactorily. Even their guns are mostly of the single-barrel type—with or without their patent 'pump' or automatic action. However, it is an encyclopedia of information on the magazine rifle.

D.K.P.

CONTRIBUTIONS

1ST PUNJAB REGIMENTAL HISTORY

MAJOR M.I. QURESHI

1 Punjab Regtl Centre, Jhelum

The history of the 1st Punjab Regiment is being compiled by the history section, set up at the Regimental Centre since April 1954. The task is expected to be completed by the beginning of 1956, and is being done under the guidance of Field Marshal Sir Claude J.E. Auchinleck, GCB, GCIE, CSI, DSO, OBE, Colonel Commandant of the Regiment.

Contributions in material/information, pertaining to this history, are requested. Any interesting anecdotes, photographs, letters, diaries, personal accounts, information on old colours and uniforms, or personal recollections should be sent in to the officer-in-charge, History Section, 1 Punjab Regimental Centre, Jhelum, West Pakistan.

The material will be securely preserved and, if required, will be sent back to the owner later.

CHANGE OF ADDRESS

To, Date.....

Secretary,
United Service Institution of India,
Kashmir House, New Delhi.

Please note my new address.

Name (in block caps).....

Rank and unit.....

Permanent address.....

Present address.....

Signature.....

SECRETARY'S NOTES

Lectures & Discussions

Between January and April the following lectures and discussions were held in New Delhi :—

"Atomic Weapons & Defence Planning", 3rd January 1955
by Professor P.M.S. Blackett, FRS,NL

"The Principles of War", 29th March 1955
by Major-General W.D.A. Lentaigne, CB, CBE, DSO

"The Light Fighter", 4th April 1955
by W.E.W. Petter, CBE, FRAeS

Enrolment of Cadets

Army, Navy and Air Force Cadets due for commissioning at the various Academies are eligible to apply for membership of the USI during their last term, i. e., during the last six months before passing out. The Council has agreed to exempt them from the payment of the entrance fee of Rs. 10, provided their enrolment forms and first subscriptions are forwarded to the U.S.I. office before they attain commissioned rank.

A substantial number of cadets from No. 2 Air Force Academy took advantage of this concession before the passing out parade in April. It is hoped that cadets at other academies will respond with similar enthusiasm to this gesture from the Council.

Life Membership

Life Membership can be paid in instalments, provided these do not exceed five and are completed in the course of the financial year of the Institution.

Subscriptions

Subscriptions are payable in advance. The financial year of the Institution is from January to December. Intending members can join at any time of the year, when back issues of the Journal for that year will be supplied.

Changes of Address

Members are requested to notify any changes of address to the Secretary's office. Please fill in the printed form given elsewhere in this issue.

Library

The library Catalogue will be very useful for members especially at outstations. Copies are available at Rs. 6/- each plus postage.

New Members

From 1st January to 31st March 1955 the following members joined the Institution :—

Dhawan, 2/Lieut. R.D., The Rajputana Rifles.
Fenwick, Captain C.E., Royal Navy.
Jag Mohan Singh Sood, Lieutenant (S), Indian Navy.
Majumdar, Lieut.-Colonel A.V., J.A.G's Department.
*Mande, 2/Lieut. Y.A., The Rajputana Rifles.
Mathur, 2/Lieut. M.N., Engineers.
*Mohite, Captain S.A., The Maratha Light Infantry.
*Raman, 2/Lieut. Revti, A.O.C.
*Raman, Captain S., E.M.E.
Rana Pratap Singh, Captain, Artillery.
Rodgers, Major J.B., 16 Light Cavalry.
Sawhney, 2/Lieut. P.C., The Bihar Regiment.
Sharma, Major K.D.V.S.
Sharma, 2/Lieut. R.M., The Grenadiers.
Sridharan, Lieut.-Commander (S) K., Indian Navy.
Subarna Chandra Kachary, Captain, The Assam Regiment.
Subrahmanyam, Esq., K., I.A.S., A.F.A., Ministry of Finance (Defence).
Tandon, Major R.K., E.M.E.
Venkatachar, Esq., C.S., I.C.S., Secretary to the President of India.
Venugopal, Captain C.H., 1 Gorkha Rifles.

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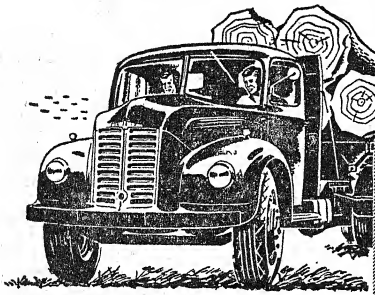

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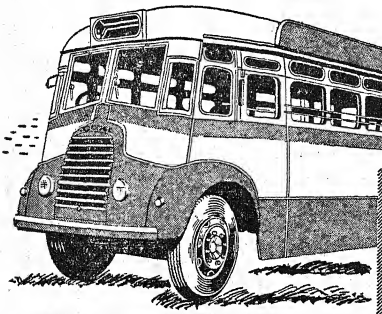

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ENROLMENT FORM

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Secretary, United Service Institution of India, Kashmir House, New Delhi.

Please enrol me as a member (or life member) of the United Service Institution of India.

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